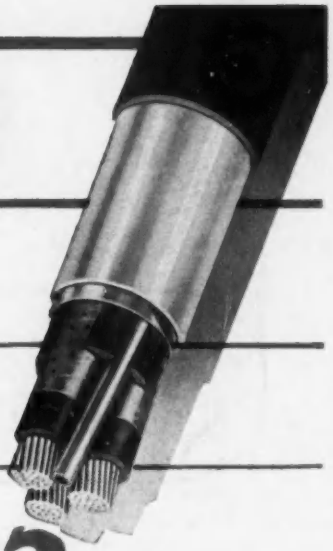
ELECTRICAL TIMES

THURSDAY
6 APRIL
1950
SIXPENCE

ALUMINIUM
SHEATHED
IMPREGNATED
PRESSURE
CABLES FOR 33kV



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C. 49
the cooker that has EVERYTHING.

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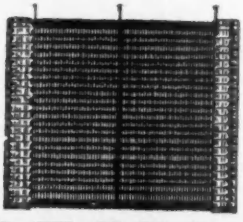

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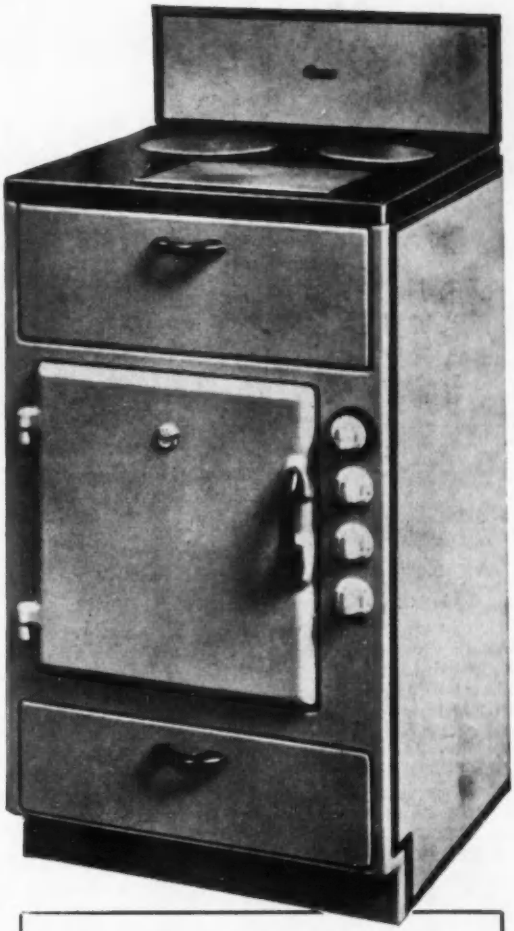

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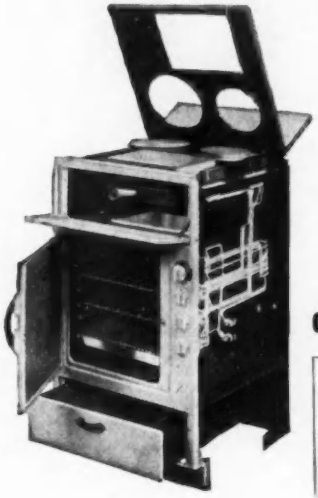

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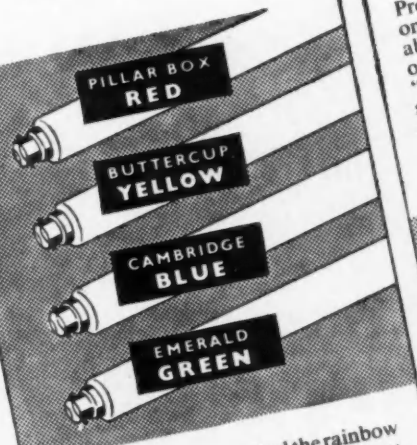

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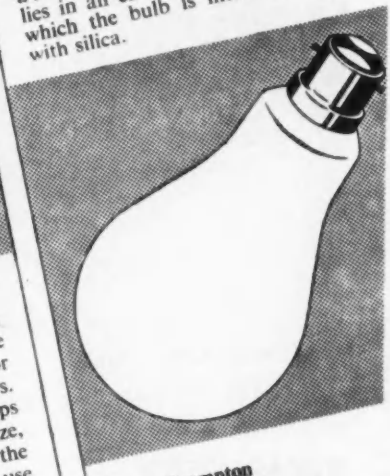

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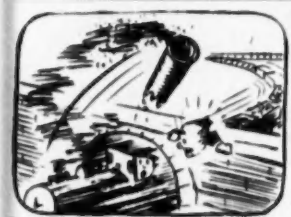

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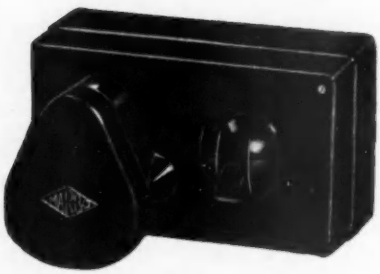

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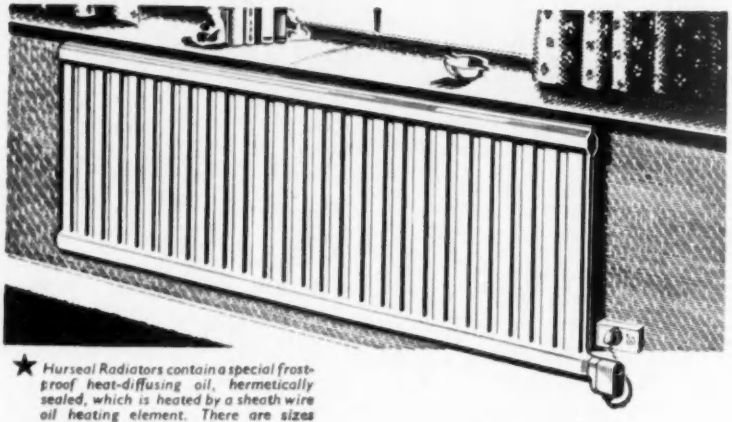

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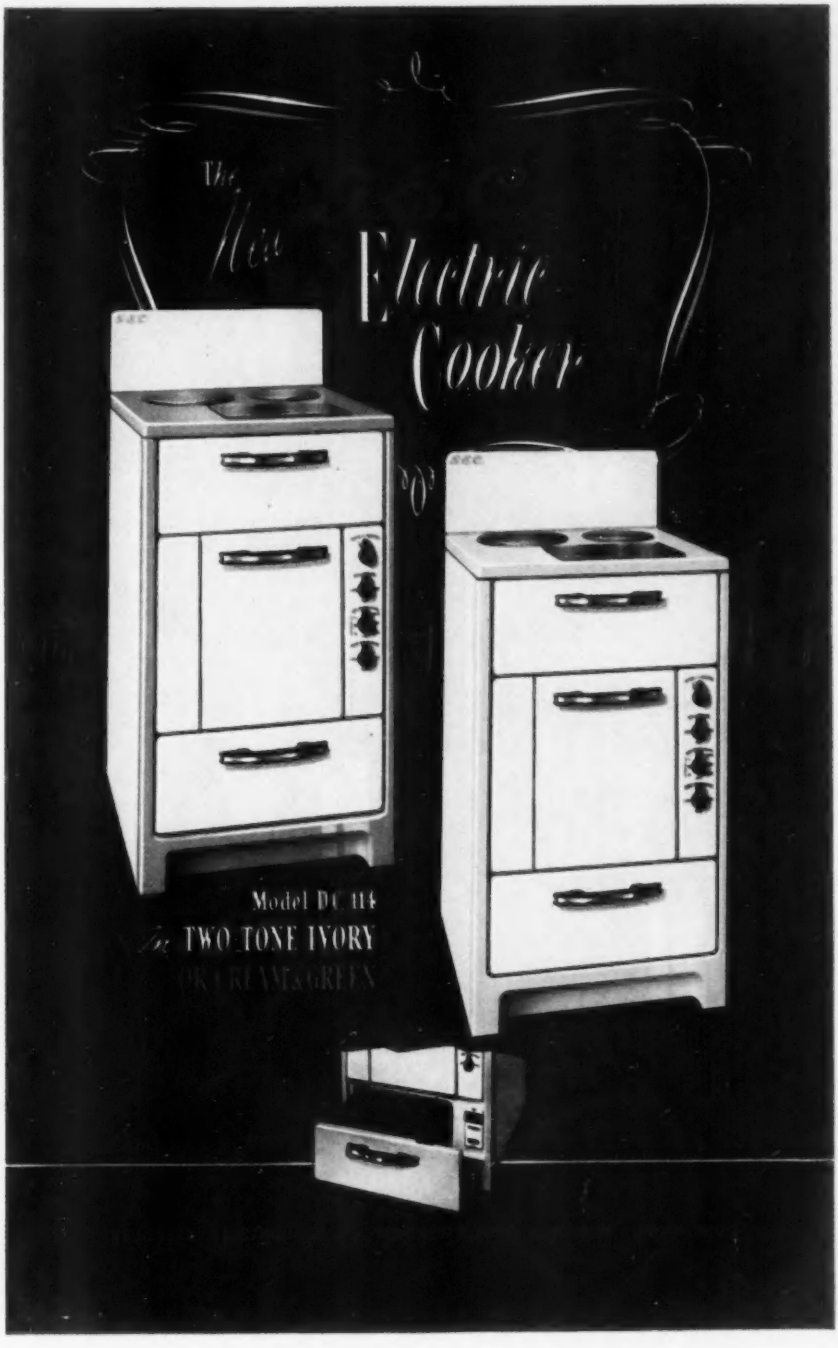
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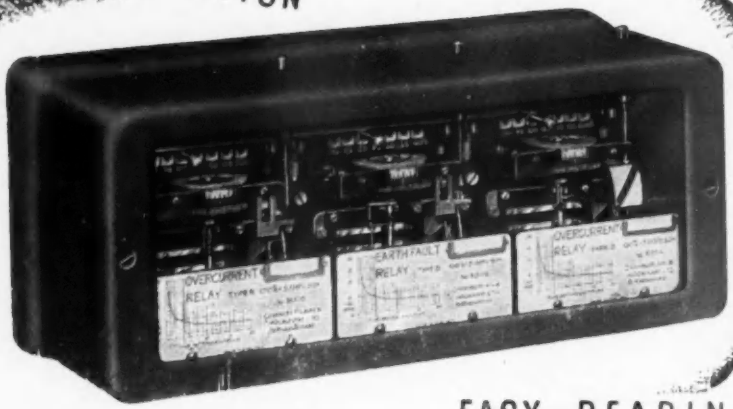

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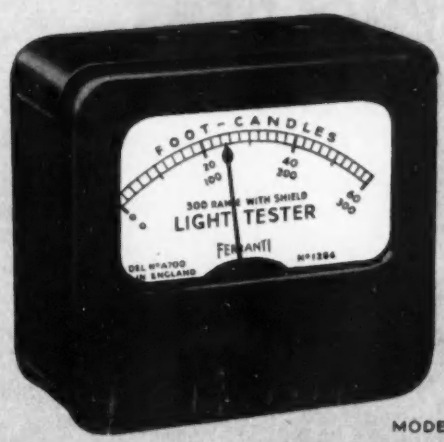

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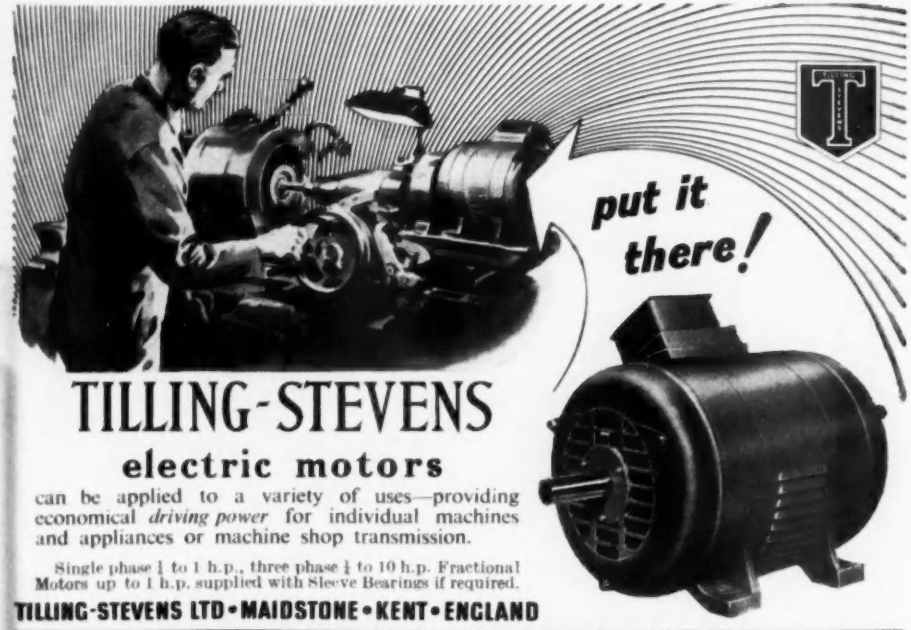

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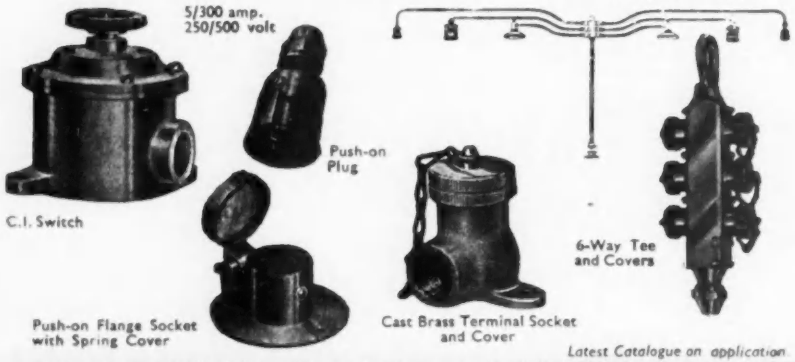
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250/500 volt
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Diagram for Temporary Lighting with Fittings connected to 6-Way Tee
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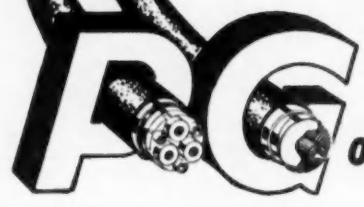

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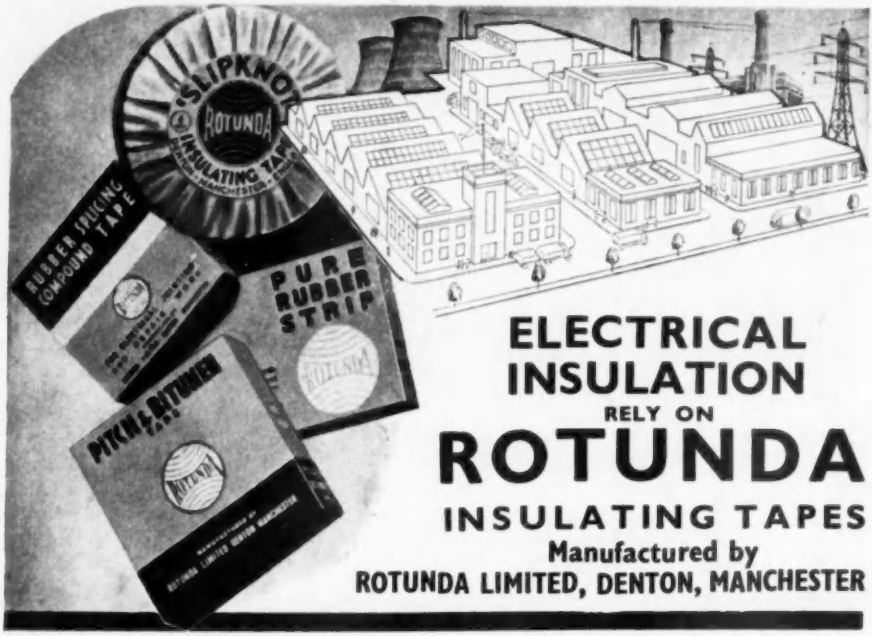

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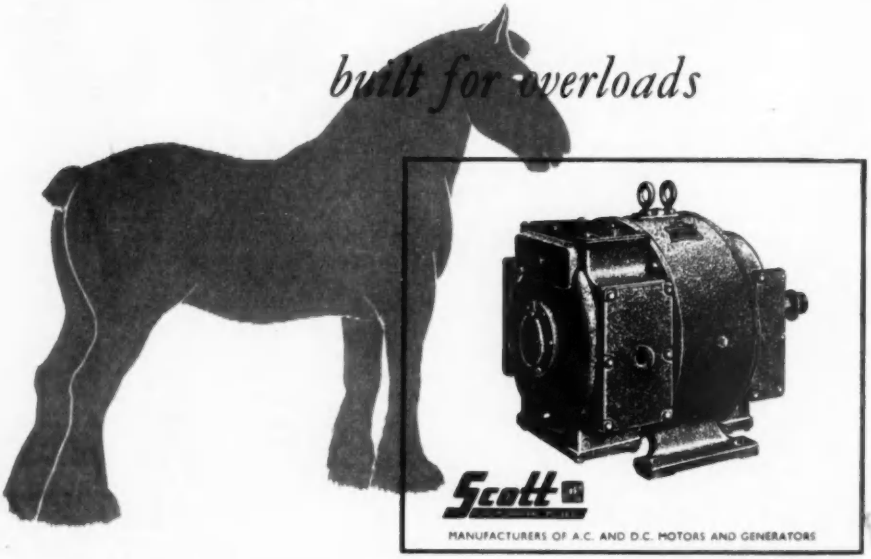

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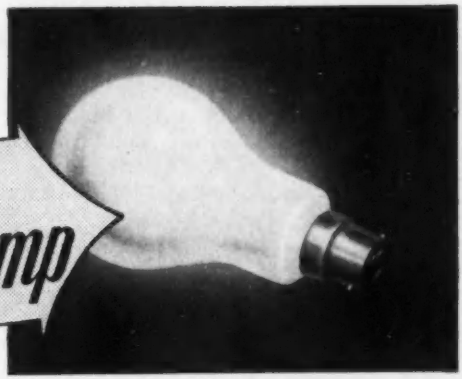

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This lamp has a coating of Silica on the inside surface of the bulb, giving almost the appearance of an Opal glass bulb. It has, therefore, been decided to revive the old trade name of SILVALUX and apply it to this new Siemens lamp.

The Silica is applied by a patented process and gives almost perfect diffusion of light. The absorption of light is quite small (only about 5%) so that the efficiency is good and the lamp has a very pleasing appearance.

For the present, the SILVALUX lamp is made in one size only—100 W—with COILED-COIL filament and is available in voltages from 200 to 260. Dimensions are as for Clear and Pearl 100 W lamps. Price each 2/-, plus P. Tax 7d. Write for Leaflet No. 1003.

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AND MELLOW light in 40 W, 4 ft. (in addition to 80 W, 5 ft.)

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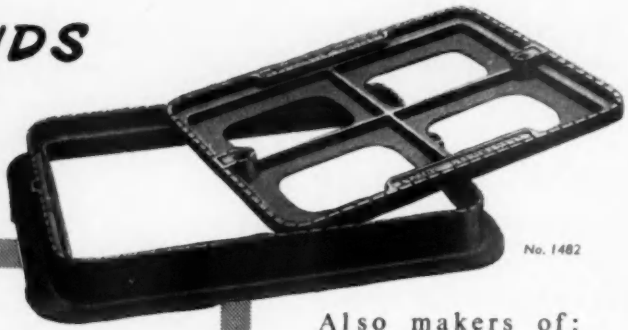

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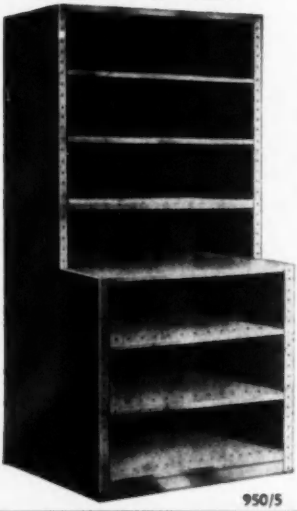

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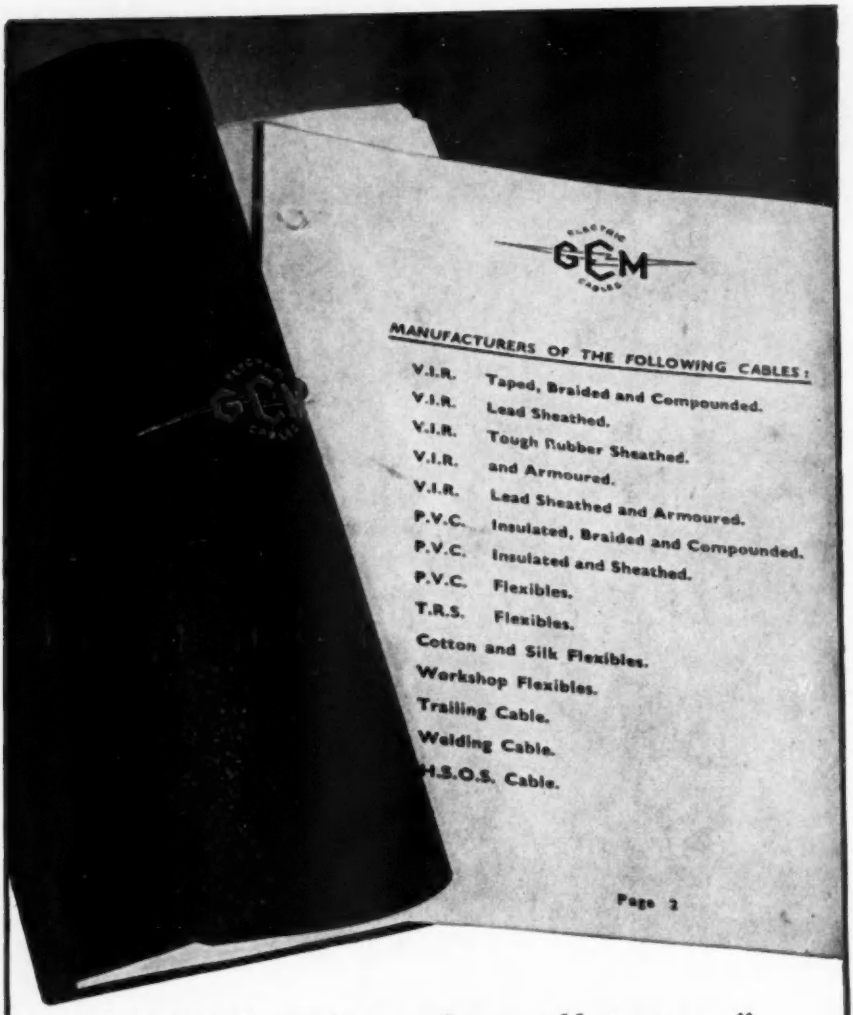

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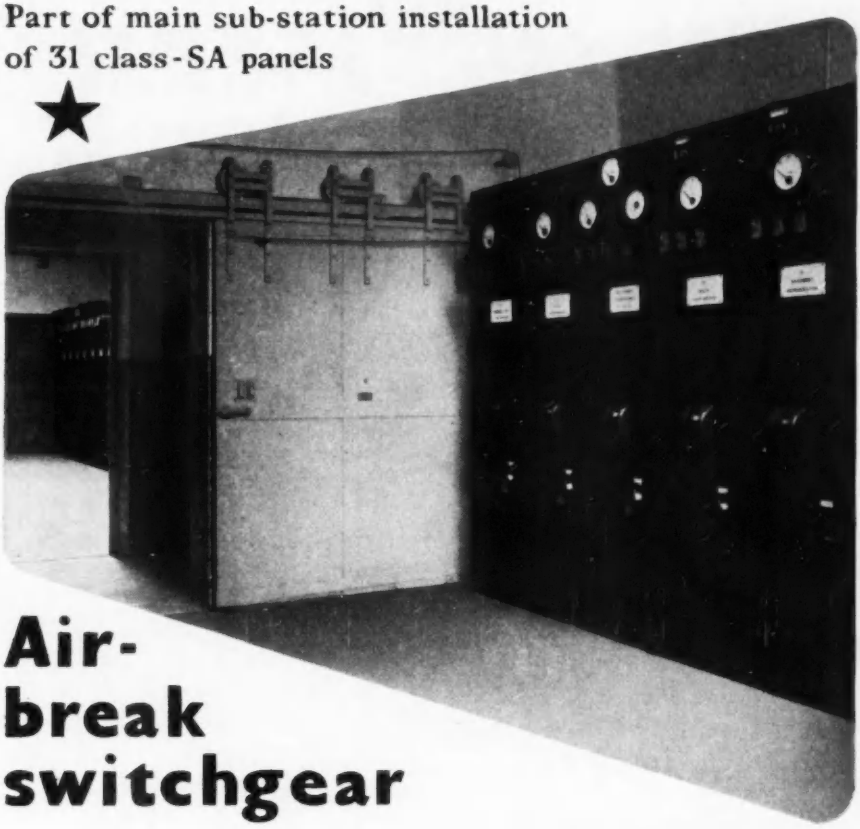

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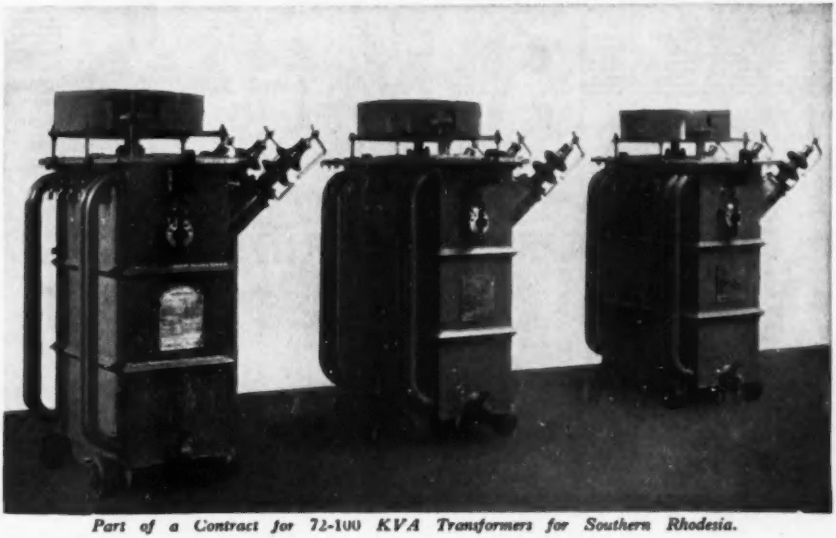

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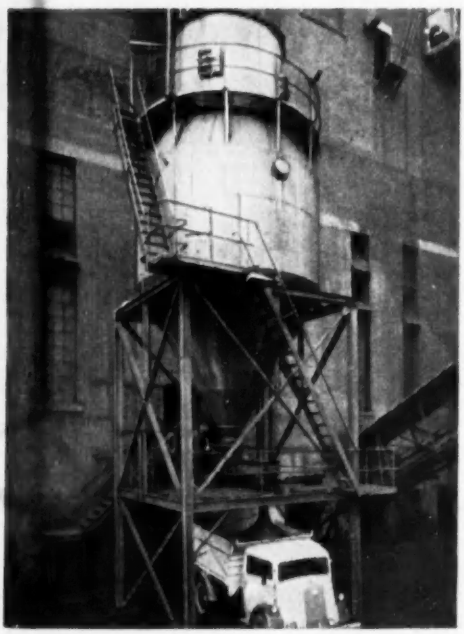

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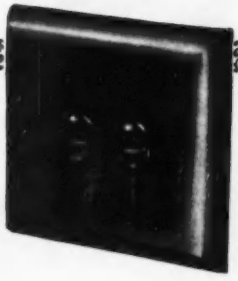

IN their resolve to make available for domestic installations a really *good* switch matching the greatly improved standards officially set for POST-WAR HOUSING, New Day faced the problem of eliminating the wear too frequently responsible for the premature failure of conventional designs.

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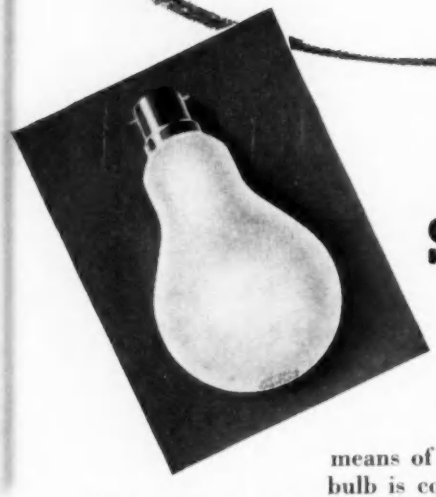

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100w. 200-260v. Coiled Coil

The new Osram Silverlight lamp has a highly efficient diffusing bulb. By means of a patented process the inside of the bulb is coated with minute particles of silica, which diffuse the light most effectively but with very low absorption. The brightness of the filament is entirely concealed and the glare-free qualities of the Osram Silverlight lamp make it a splendid proposition for installations having wholly or partially exposed bulbs, such as standard or table lamps, open shades, cinema canopies etc., or where it is necessary to eliminate lamp holder and support shadows.

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Osram COLOURED FLUORESCENT LAMPS

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4 ft. 40 watts

This has many applications in restaurants, cafes, hotels, cinema lounges etc., and in the home, where the prevailing decorations are warm and the atmosphere intimate and relaxing.

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From the *EVENING NEWS*
December 14th, 1949

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When daylight fails, the ELLIOTT photo-electric control automatically switches the lights ON

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The ELLIOTT Controller ensures absolutely reliable trouble-free lighting control, even after power cuts. Fully automatic, requires no resetting, and no routine maintenance. Especially valuable for traffic signs on isolated sites and for factory lighting.

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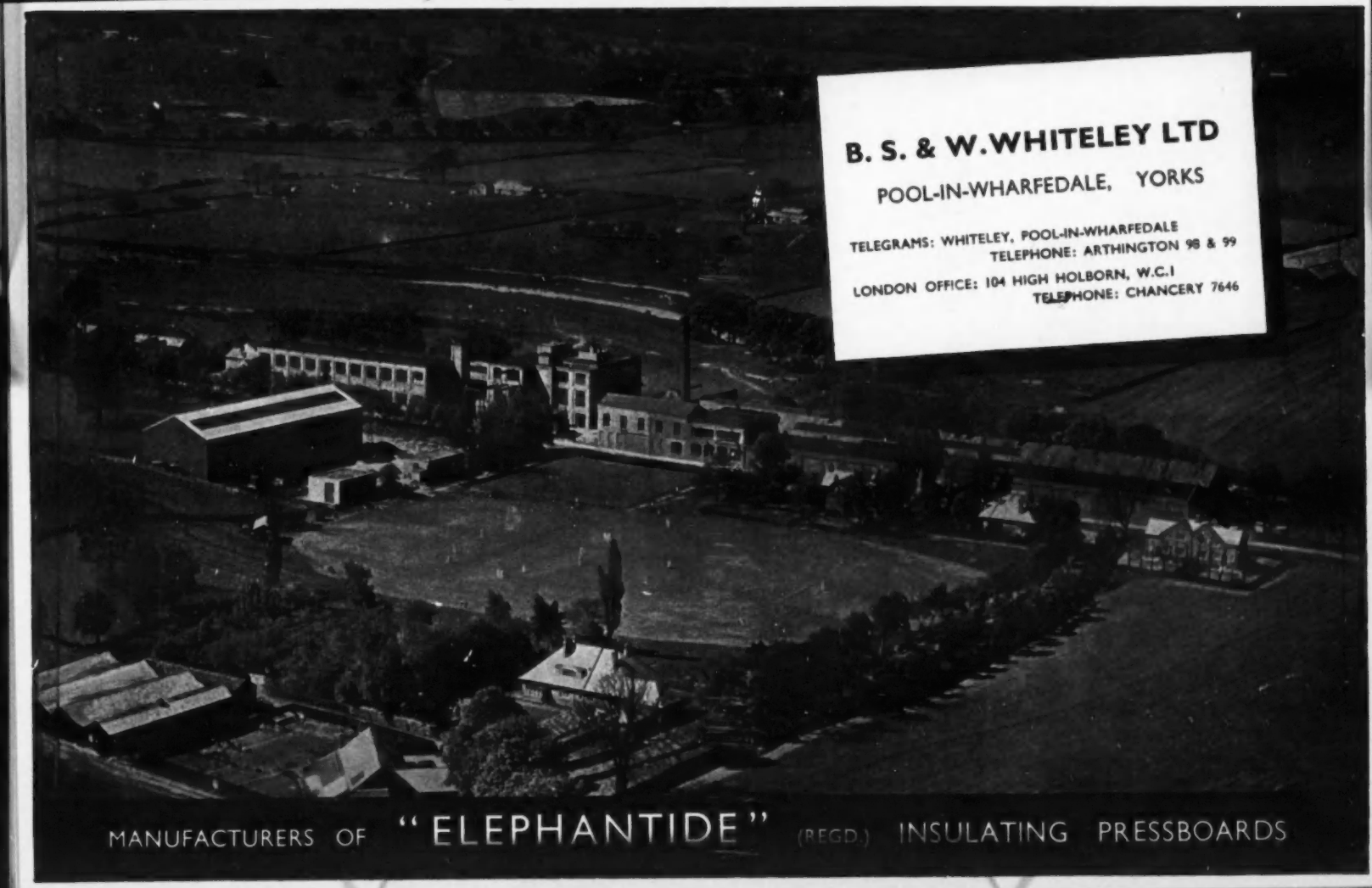
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MK *Fused-Switchplug*

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the extra large XCEL oven will take the largest joint

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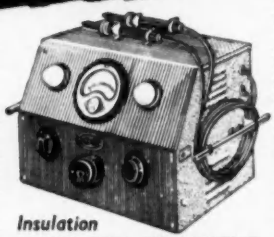

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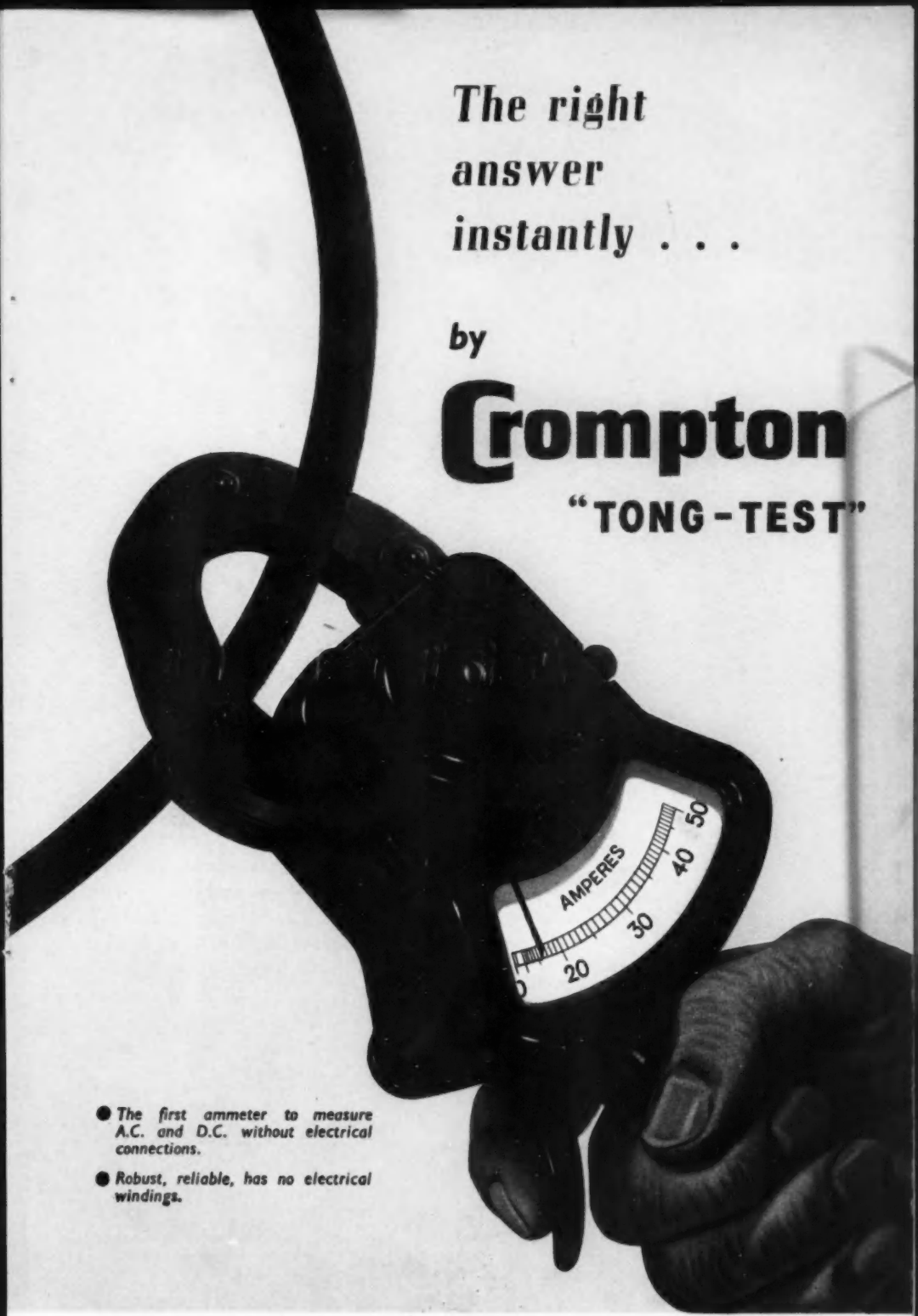

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ELECTRICAL TIMES

Vol. 117 No. 3048 THURSDAY, 6 APRIL, 1950

FIFTY-NINTH YEAR OF PUBLICATION

PUBLISHED EVERY THURSDAY

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SUBSCRIPTION RATES.—United Kingdom and Overseas £1 15s. per annum. Canada C$6, U.S.A. $5 per annum. Subscriptions are payable in advance and may commence with any issue throughout the year. Overseas subscriptions may be paid to The Electrical Times Limited by banker's draft, cheque or international money order. Single copies 6d. each

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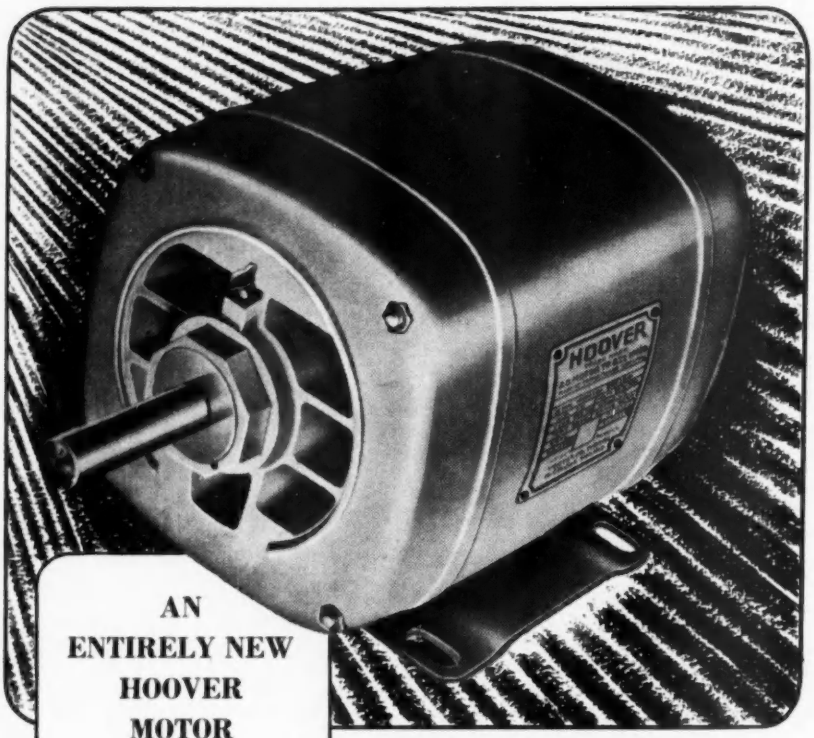

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Editorial

WHAT IS THE TARGET?

REALISING that targets nowadays seem to be things which are easily missed, the Economic Survey for 1950 refrains from giving any forecast in hard figures, and contents itself with a summary of capital investments and a few platitudes and pious hopes. We are told that . . . "the amount of new generating plant commissioned should exceed the growth of demand. . . ." A rough method of estimation is to work back from the figure of £54 million which the Survey allocates for generation. At £50/kW for new plant and £35/kW for extensions, this would allow for about 1,200 MW, so that we can take this figure as an absolute maximum. The target for 1949 was 1,000 MW, of which 826·26 was installed and 703 MW actually commissioned. Bearing in mind that the B.E.A. only took over the progressing of their own power stations in June, 1949, we believe that they will this year approach the estimate more closely, and confidently expect that 1,000 MW will actually be installed.

INCONSISTENCIES

SO FAR as electricity supply is concerned, the Survey does not show the logical attitude which one should be entitled to expect from a responsible source. The reduction of £5 million on distribution which, as has been previously announced, will fall heavily on rural development, accords ill with the statement elsewhere in the publication regarding the need to give first place to investment in those industries where increased output and lower costs will directly or indirectly assist the balance of payments. Surely, agriculture comes under this heading? Again, the insistence in the Survey that expenditure on maintenance and replacement must, in "many instances," have first claim on investment resources, is accompanied by a reduction in the B.E.A.'s allocation for maintenance and repair from £10.6 million to £8 million. Does this indicate that war-time arrears of maintenance have been cleared off? Or does it indicate a hope that the B.E.A., having had such encouraging results in improving plant availability, is expected to perform still better?

THAT COOKER LOAD

ATTENTION has recently been focused on the comparative production figures of gas and electric cookers. Present production of gas cookers is nearly three times that of electric cookers, the approximate figures for 1949 being 633,600 and 223,200. There is, of course, no startling novelty in the situation. While official statistics are not available, reliable estimates put the corresponding figures for 1938 at 750,000 and 200,000 respectively. In addition, the P.E.P. report on domestic appliances, which was issued as long ago as 1945, forecast an annual average of 850,000 and 360,000 and, although these figures are well on the high side, they prove that the general outline of the situation was quite clearly foreseen. There is, however, a vast difference between foreseeing a certain situation and tamely accepting it as being inevitable. The fact remains that every gas cooker installed represents lost load to the industry, and that, if we assess the average annual load at the modest amount of 1,000 kWh, the total additional load which can be regarded as being lost to gas cookers is over 600 million units. In other words, we are missing the opportunity of adding, each year, the equivalent of half the present traction load for the whole country. Electrifying the kitchens could be more profitable than electrifying the railways.

THE NELSON TOUCH

SO FAR from producing more cookers, we are not even going to sell all those we produce, until we get rid of our inhibitions regarding load-building. For so many years we have allowed "Keep off the Peak" and "Mummy forgot . . ." to dominate our thoughts and actions, that many of the public feel that the use of electricity is, at least, a misdemeanour, and that the installation of a cooker cannot be contemplated without a medical certificate. In many areas, the attitude adopted is permissive rather than persuasive; consumers are allowed to install cookers rather than induced to. This lukewarm outlook, however correct it may be for avoiding peak troubles, is certainly not going to fill the valleys either. The time has come when we must decide whether to play for safety, or to adopt the Nelson technique and, turning a blind eye on load-shedding, hoist the well-remembered signal : "Use Electricity"—and mean it.

PRO AND CON

PERHAPS the last couple of winters have been mild enough to encourage the flower of optimism to bloom too early, but many in the industry feel that too much is made of the load-shedding bogey. However serious it may be to industries employing continuous production methods, the net effect in the domestic field is, they say, an annoyance which is threatened far more often than it actually happens. Others disagree, pointing out that the pursuit of an unrestricted development policy would lead to serious loss of goodwill, in the event of a hard winter, which is undoubtedly true. At the same time, no battle was ever won without taking risks, and if we wait too long we shall have lost more than goodwill—we shall have lost the cooking load to an industry which has not had £5 million lopped off its distribution budget, which has no peak troubles and whose cookers are inherently cheaper to manufacture. The dice are loaded against us, and the fight will be no easy one. Merely to say "Use Electricity" will not be enough unless we back it up with hire-purchase on easier terms, maybe straight hire, intensive selling, and, above all, adequate publicity.

RATIONALISED UNITS

THE discussion, following the recent I.E.E. symposium on the M.K.S. System of Units, showed a singular unanimity in favour of the adoption of the rationalised system as far as electrical engineering science was concerned. Unfortunately, the C.G.S. system is used widely in all branches of applied science, particularly in physics and chemistry, and in most schools electricity is taught as a branch of physics. Unless, therefore, the teacher of physics is prepared to adopt M.K.S. units generally, the student of electricity will inevitably find that his introduction to the subject will be in C.G.S. units at school with a transition to M.K.S. units when he reaches the university or technical college. In view of the importance of a rationalised unit system, and the advantages to be derived from its use, there would seem to be a strong case for the universal adoption of M.K.S. units.

THOUGHTS ON OSCILLOSCOPES

A FASCINATING occupation which may be indulged in at the Physical Society's Exhibition is to speculate on the ultimate destiny of each new and unfamiliar device. Some will inevitably remain the silent servant of some abstruse piece of research unknown to the general run of engineers, while others will become the familiar friend of all. The cathode ray oscilloscope is, perhaps, one of the outstanding examples of the second class. It is nearly a century since Pluckner first demonstrated that rays given off by the cathode of a Geissler tube were influenced by a magnetic field. Yet, at the beginning of the last war, the cathode ray oscilloscope was still regarded more as a laboratory instrument than a working tool, except, perhaps to the radio industry. The maintenance electrician used to be content with a test lamp until the increasing complexity of the gear under his charge necessitated the adoption of the multi-range testing set. With the eventual growth of electronics in industry, it is reasonable to suppose that one day a portable oscilloscope with, say, a one-inch tube, will repose at the bottom of every toolbag, along with the pliers and black tape.

Meteor

Load Sharing on Parallel Feeders

THE USE OF QUADRATURE BOOSTER TRANSFORMERS

By A. SALZMANN, Dipl.Ing., A.M.I.E.E.

IN transmission systems, overloaded feeders are frequently reinforced by a second feeder in parallel. This is often operated at a higher voltage than the original feeder, with step-up and step-down transformers, as shown in Fig. 1.

It is obvious when two parallel feeders operating at, say, 33 kV and 11 kV, their characteristics must be dissimilar (different resistance/reactance ratio) and most undesirable and uneconomic load sharing may occur. Load sharing control by ratio changing on the step-up and step-down transformers will have little effect on the distribution of the power between the feeders. (See example.) The injected e.m.f. by the transformer ratio taps in phase with the system phase voltage will force a circulating current through the two parallel feeders forming a closed loop circuit. As the reactance in the latter is usually large compared with the resistance, the circulating current is mainly wattless and the reinforcing 33 kV feeder will pick up reactive power. It is possible that the 11 kV feeder will still remain overloaded after reinforcing.

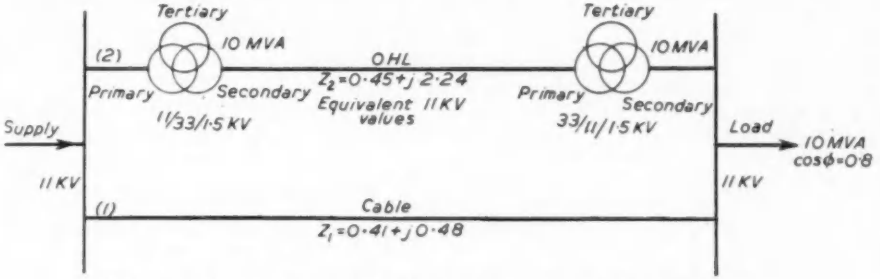

Fig. 1.—Single line diagram for parallel feeders with dissimilar characteristics

Equal kilowatt sharing between the two feeders is secured only by incorporating phase angle control equipment in the new feeder. By separate injection of variable controlled voltages in phase and in quadrature with the system phase voltage we shall be able to control kilowatts and kilovars at will in each feeder.

Fundamental Principle

Consider the simple circuit shown in Fig. 2. We assume the line reactances are negligible and the 3-phase star connected load circuit requires 12 A per phase at unity power factor. This circuit represents a closed loop with one load point tapped off at the remote end. The current division between the two branches is determined by the resistances of the loop and given by $I_1 = IR_2/(R_1+R_2) = 12\times 2/(1+2) = 8$ A and $I_2 = IR_1/(R_1+R_2) = 4$ A and the voltage drop consumed in the two sections are equal $e_1 = e_2 = 8\times 1 = 4\times 2 = 8$ V. Thus we have to maintain at the sending end phase voltages of the magnitude 108 V in order to produce at the remote end of the feeders 100 V.

Obviously the feeders are unequally loaded because of their dissimilar line constants. Feeder (1) carries approx. 66% and feeder (2) 33% of the total load. By injecting an EMF e_b in the branch with the larger resistance (feeder 2) at any convenient point but in phase with the system phase voltage, a circulating current I_c will flow through the loop and modify the current distribution i.e. a voltage of the magnitude of 6 V will force a circulating current $I_c = e_b/(R_1+R_2) = 6/3 = 2$A. This current super-

imposed on each feeder equalises the load sharing between the feeders. It adds to the load current in feeder (2) and subtracts from the load current in feeder (1).

It follows to bring the currents in the two sections equal to each other we require a voltage drop of the value $e_1 = \frac{1}{2} IR_1 = 6$ V along feeder (1) and $e_2 = \frac{1}{2} IR_2 = 6 \times 2 = 12$ V along feeder (2). This is achieved by introducing a boost voltage of the value of $(e_2 - e_1) = 12 - 6 = 6$ V in the branch with the larger resistance. The voltage at the remote end of the feeder remains constant (100 V) by maintaining a sending end voltage of 106 V.

Take an example: It is required to load line (1) with 40% and line (2) with 60% of the total load. By injecting a boost voltage in feeder (2) of the value $e_b = e_2 - e_1 = I_2 \times R_2 - I_1 \times R_1 = 0{\cdot}6 \times 12 \times 2 - 0{\cdot}4 \times 12 \times 1 = 9{\cdot}6$ V the circulating current $I_c = 9{\cdot}6/(1+2) = 3{\cdot}2$ A increases $I_2 \rightarrow (4 + 3{\cdot}2 = 7{\cdot}2$A) and decreases $I_1 \rightarrow (8 - 3{\cdot}2) = 4{\cdot}8$ A, therefore we will dispatch via route (1) 40% and via route (2) 60% of the total load.

The circuit shown in Fig. 2 is simple, as the line reactances have been omitted. Load sharing between feeders with resistance and reactance can be determined in a similar manner. With equal ratios of X/R, the currents in each section are in phase with each other under all load conditions, but will differ in value in case the line impedances are unequal in magnitude. With unequal ratios of X/R the currents in the two branches will differ in phase and magnitude.

This is understood from the vector diagram shown in Fig. 2a, taking receiving end voltage E_r as reference vector. The current division is determined by the impedance characteristic of the loop. Current I_1 given by

$$I \angle \Phi^\circ \times \frac{Z_2 \angle \theta^\circ_2}{Z_{12} \angle \theta^\circ_{12}}$$

lags behind E_r by an angle Φ_1 and current I_2 given by

$$I \angle \Phi^\circ \times \frac{Z_1 \angle \theta^\circ_1}{Z_{12} \angle \theta^\circ_{12}}$$

lags behind E_r by an angle Φ_2 where Φ = lagging load p.f., Z_1 Z_2 = line impedances, Z_{12} = loop impedance θ_1, θ_2, θ_{12} impedance angles, while the impedance drops $e_1 = e_2$ consumed in each section and given by $I_1 \angle \Phi^\circ_1 \times Z_1 \angle \theta^\circ_1$ and $I_2 \angle \Phi^\circ_2 \times Z_2 \angle \theta^\circ_2$ are equal.

By injecting a boost voltage e_b = (SB) at the sending end of feeder (2) whose components vary in phase (S3) and in quadrature (B3) with E_s, any desired amount of current can be transferred from section (1) to section (2). The circulating current $I_c = e_b/Z_{12}$ driven by the boost voltage through the loop circuit lags nearly 90° behind e_b, increases the current in feeder (2) ($I_{2T} = I_2 + I_c$) and decreases the current in feeder (1) ($I_{1T} = I_1 - I_c$).

Section (1) consumes voltage e_1 and section (2) the voltage $(e_1 + e_b)$.

To bring the total currents $I_{1T} = I_1 - I_c$ and $I_{2T} = I_2 + I_c$ in phase and equal to each other, we have to inject a boost voltage equal in phase and magnitude to $(e_2 - e_1)$ and given by

$$e_b = (e_2 - e_1)$$
$$= (\tfrac{1}{2} I \angle \Phi^\circ \times Z_2 \angle \theta_2^\circ - \tfrac{1}{2} I \angle \Phi^\circ \times Z_1 \angle \theta_1^\circ)$$

It should be emphasised that the busbar voltage at the sending end must be adjusted in order to maintain the voltage at the receiving end constant for any division of currents between the two feeders. This voltage variation is small and has not been taken into account in the vector diagram. (See following example.)

We realise load sharing between feeders with dissimilar characteristics can be controlled by introducing a variable boost voltage in the section with larger impedance.

Control of load division may be desired to limit the current on account of the rating of one feeder and from standpoint of obtaining minimum copper loss.

Example

An existing 11 kV cable, shown in Fig. 1, is to be reinforced by a 33 kV feeder with step-up and step-down transformers at both ends. The feeders are operating in parallel, and the load of 10 MVA at p.f. 0·8 is connected to the busbars at the remote end. The transformers are linked by a 0·2 sq in. overhead line of length 8,000 yds having a resistance 0·12 ohms/1,000 yds and reactance 0·34 ohms/1,000 yds. Both units are star-delta-star connected 33/1·5/11 kV transformers, the delta connected tertiary winding being used to permit of unbalanced loading and the rating of each unit is 10 MVA with reactance of 8%, and resistance of the high and low voltage windings are 0·88 and 0·075 ohms respectively.

On load voltage regulating equipment on the h.t. side operated automatically provides for ±12% in-phase voltage regulation in 16 steps each of 1·5%, while the quadrature regulation leading or lagging is provided by a separate quadrature booster located at the sending end.

It is assumed that the capacitance charging current in the 11 kV underground cable is negligible. Cable constants: Length, 5,000 yds. Cross sectional area, 0·3 sq in. Permissible continuous current, 380 A. Total resistance 0·41, and reactance 0·48 ohms.

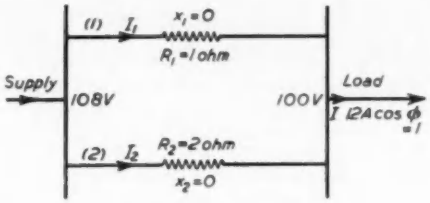

Fig. 2.—Elementary circuit with one incoming feed, two parallel feeders and one load circuit

Referred to 33 kV:
$Z_2' = (33/11)^2 \times (0{\cdot}45 + j\,2{\cdot}24) =$
$20{\cdot}57 \angle 78{\cdot}6°$ ohms.

Impedance of the 11 kV feeder:
Referred to 11 kV:
$Z_1 = 0{\cdot}41 + j\,0{\cdot}48 = 0{\cdot}63 \angle 49{\cdot}5°$ ohms.
Referred to 33 kV:
$Z_1' = (33/11)^2 \times (0{\cdot}41 + j\,0{\cdot}48) =$
$5{\cdot}67 \angle 49{\cdot}5°$ ohms.

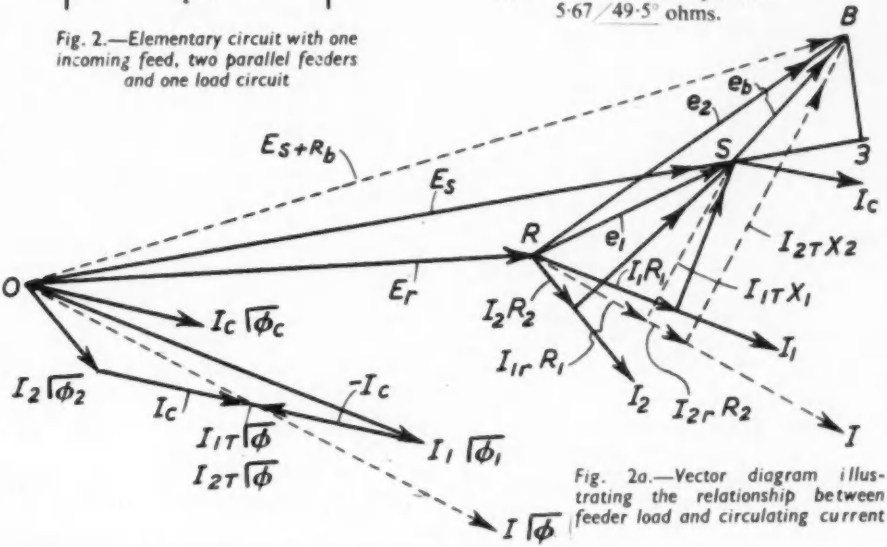

Fig. 2a.—Vector diagram illustrating the relationship between feeder load and circulating current

The following information is required:—
(*a*) Load sharing when no voltage boosts are injected into the reinforcing feeder.
(*b*) Load sharing with in-phase voltages injected into the 33 kV line.
(*c*) Load sharing with in-phase and quadrature voltages injected separately into the 33 kV feeder.

Solution

(*a*) Full load transformer current:
$I = 10{,}000/\sqrt{3} \times 33 = 175{\cdot}2$ A.

Transformer reactance referred to 33 kV:
$$X = \frac{8 \times 33 \times 1{,}000}{100 \times \sqrt{3} \times 175{\cdot}2} = 8{\cdot}704 \text{ ohms.}$$

Total reactance of the 33 kV feeder referred to 11 kV:
$(8 \times 0{\cdot}34 + 2 \times 8{\cdot}704) \times (11/33)^2 = 2{\cdot}24$ ohms.

Total resistance of the 33 kV feeder referred to 11 kV:
$2 \times 0{\cdot}075 + (8 \times 0{\cdot}12 + 2 \times 0{\cdot}88) \times (11/33)^2$
$= 0{\cdot}45$ ohms.

Impedance of the 33 kV feeder:
Referred to 11 kV:
$Z_2 = 0{\cdot}45 + j\,2{\cdot}24 = 2{\cdot}285 \angle 78{\cdot}6°$ ohms.

Impedance of the loop circuit:
Referred to 11 kV:
$Z_{12} = Z_1 + Z_2 = 0{\cdot}86 + j\,2{\cdot}72 =$
$2{\cdot}85 \angle 72{\cdot}4°$ ohms.
Referred to 33 kV:
$Z_{12}' = Z_1' + Z_2' = 7{\cdot}74 + j\,24{\cdot}48 =$
$25{\cdot}65 \angle 72{\cdot}4°$ ohms.

Load: Power and reactive power:
$P = 10{,}000 \angle 36{\cdot}8°$ kVA $= 10{,}000(0{\cdot}8 - j\,0{\cdot}6)$
$= 8{,}000 - j\,5{,}990$ kVA.
Kilowatts: 8,000. Kilovars: 5,990.

Load sharing:
Feeder (1):
$$P_1 = \frac{P\,Z_2}{Z_{12}} = \frac{10{,}000 \angle 36{\cdot}8° \times 2{\cdot}285 \angle 78{\cdot}6°}{2{\cdot}85 \angle 72{\cdot}4°}$$
$= 8{,}021 \angle 30{\cdot}6°$
$P_1 = 6{,}900 - j\,4{,}083$ kVA.

Feeder (2):
$$P_2 = \frac{P\,Z_1}{Z_{12}} = \frac{10{,}000 \angle 36{\cdot}8° \times 0{\cdot}63 \angle 49{\cdot}5°}{2{\cdot}85 \angle 72{\cdot}4°}$$
$= 2{,}211 \angle 59{\cdot}7°$
$P_2 = 1{,}110 - j\,1{,}908$ kVA.

As a check:
The sum of the power and reactive com-

ponents of feeder (1) and (2) must be equal to those of the load.

$$P_1+P_2=6{,}900-j\,4{,}083+1{,}110-j\,1{,}908$$
$$=8{,}010-j\,5{,}991.$$

Line currents:

Feeder (1):

$$I_1=\frac{P_1\angle 30{\cdot}6^\circ}{\sqrt{3}\times 11}=\frac{8{,}021\angle 30{\cdot}6^\circ}{19{\cdot}1}$$
$$=422\angle 30{\cdot}6^\circ=363-j\,215\text{ A.}$$

Feeder (2):

$$I_2=\frac{P_2\angle 59{\cdot}7^\circ}{\sqrt{3}\times 11}=\frac{2{,}211\angle 59{\cdot}7^\circ}{19{\cdot}1}$$
$$=116\angle 59{\cdot}7^\circ=59-j\,99{\cdot}5\text{ A.}$$

or alternatively referred to 33 kV

$$I_2{}^1=1/3\times 116\angle 59{\cdot}7^\circ=38{\cdot}7\angle 59{\cdot}7^\circ\text{ A.}$$

Second check:

Voltage drop in each feeder must be equal.

Feeder (1):

$$e_1=I_1\angle 30{\cdot}6^\circ\times Z_1\angle 49{\cdot}5^\circ=$$
$$422\angle 30{\cdot}6^\circ\times 0{\cdot}63\angle 49{\cdot}5^\circ=266\angle 18{\cdot}9^\circ$$
$$e_1=253+j\,84{\cdot}5\text{ volts.}$$

Feeder (2):

$$e_2=I_2{}^1\angle 59{\cdot}7^\circ\times Z_2{}^1\angle 78{\cdot}6^\circ=$$
$$38{\cdot}7\angle 59{\cdot}7^\circ\times 20{\cdot}57\angle 78{\cdot}6^\circ$$
$$e_2=799{\cdot}5\angle 18{\cdot}9^\circ=759+j\,253{\cdot}5\text{ volts}$$

as expected.

$(e_2=3\times e_1)$.

Sending end phase voltage:

Receiving end vector E_r is taken as reference vector.

$$E_s=E_r\angle 0^\circ+e_1\angle 18{\cdot}9^\circ=6{,}350+253+$$
$$j\,84{\cdot}5=6{,}603\angle 0{\cdot}7^\circ\text{ V.}$$

From these calculations it is understood that the system cannot be operated efficiently if the load sharing is uncontrolled. The existing feeder remains overloaded (permissible current 380 A) and the new feeder carries $(2{,}210/10{,}000)\times 100=22{\cdot}1\%$ of the total load and picks up only $(1{,}110/8{,}000)\times 100=13{\cdot}9\%$ of the power.

(*b*) Assuming the voltage injected into the reinforcing feeder is in-phase with the system voltage referred to 11 kV and of the magnitude $e_2{}^1=253+j\,0$ equal to the resistive voltage drop in the feeder (2). (Case (a).) Notice to avoid mathematical complications the injected in-phase voltage $e_2{}^1$ is in phase with the reference vector E_r (see Fig. 2a). The resulting error is negligible when assuming the in-phase voltage S3 is parallel to E_r, as the angle between sending and receiving end voltages is small. This voltage forces a circulating current through the closed loop circuit and the latter is given by

$$I_c=\frac{e_2{}^1\angle 0^\circ}{Z_{12}\angle 72{\cdot}4^\circ}=\frac{253\angle 0^\circ}{2{\cdot}85\angle 72{\cdot}4^\circ}$$
$$=88{\cdot}5\angle 72{\cdot}4^\circ=26{\cdot}6-j\,84{\cdot}3\text{ A.}$$

The circulating current adds to the load current in feeder (2) and the total current is given by

$$I_{2T}=I_2+I_c=59{\cdot}0-j\,99{\cdot}5+26{\cdot}6-j\,84{\cdot}3$$
$$=85{\cdot}6-j\,183{\cdot}8=202{\cdot}7\angle 65{\cdot}1^\circ$$

while I_c subtracts from the load current in the feeder (1). The total current in feeder (1) is

$$I_{1T}=I_1-I_c=363-j\,215-(26{\cdot}6-j\,84{\cdot}3)$$
$$=336{\cdot}4-j\,130{\cdot}7=360{\cdot}9\angle 21{\cdot}2^\circ$$

It should be noted, the variation of transformer impedance (occurring when injecting in-phase voltage controlled by ratio changing on the step-up or step-down transformers) has been ignored as its influence is negligible.

Load distribution:

Feeder (1): Kilowatts.

$$P_{1W}=\sqrt{3}\times I_{1T}\times E\cos 21{\cdot}2^\circ=6{,}385\text{ kW}$$

Feeder (1): Kilovars.

$$P_{1R}=\sqrt{3}\times I_{1T}\times E\sin 21{\cdot}2^\circ=2{,}480\text{ kVAR}$$

Feeder (2): Kilowatts.

$$P_{2W}=\sqrt{3}\times I_{2T}\times E\cos 65{\cdot}1^\circ=1{,}620\text{ kW}$$

Feeder (2): Kilovars.

$$P_{2R}=\sqrt{3}\times I_{2T}\times E\sin 65{\cdot}1^\circ=3{,}510\text{ kVAR}$$

Voltage drop:

Feeder (1):

$$e_1=I_{1T}\angle 21{\cdot}2^\circ\times Z_1\angle 49{\cdot}5^\circ$$
$$=360{\cdot}9\angle 21{\cdot}2^\circ\times 0{\cdot}63\angle 49{\cdot}5^\circ=227\angle 28{\cdot}3^\circ$$
$$e_1=200+j\,105\text{ Volts}$$

Check: e_2 must be equal 3 e_1. Referring e_2 to 33 kV we obtain

$$e_2=(1/3\times I_{2T}\angle 65{\cdot}1^\circ\times Z_2{}^1\angle 78{\cdot}6^\circ)$$
$$=67{\cdot}85\angle 65{\cdot}1^\circ\times 20{\cdot}57\angle 78{\cdot}6^\circ$$
$$e_2=1{,}400\angle 13{\cdot}5^\circ-759\angle 0^\circ=601+j\,320$$

volts.

Sending end phase voltage:

$$E_s=6{,}350\angle 0^\circ+200+j\,104$$
$$=6{,}550+j\,104=6{,}551\angle 0{\cdot}9^\circ\text{ volts.}$$

It follows an in-phase boost voltage of 253 V; 4% referred to 11 kV or 759 V referred to 33 kV has no large effect on the load distribution. The reinforcing feeder will carry $100\sqrt{3}\ I_{2T}\ E/10{,}000=3{,}860\times 100/10{,}000=38{\cdot}6\%$ of the total load but mainly wattless power $(3{,}510\times 100/5{,}990)=(58{\cdot}5\%)$ and will pick up only $1{,}620\times 100/8{,}000=20\%$ of the power. Even a boost of 10% ($e_2{}^{11}=10\times 19{,}100/100=1{,}910$ V) referred to 33 kV or 636 V referred to 11 kV will cause unequal loading of each feeder.

With a 10% in-phase boost we obtain the following values:—

Circulating current:

$$I_c=\frac{e_2{}^{11}\angle 0^\circ}{Z_{12}\angle 72{\cdot}4^\circ}=222\angle 72{\cdot}4^\circ=67{\cdot}5-j\,221$$

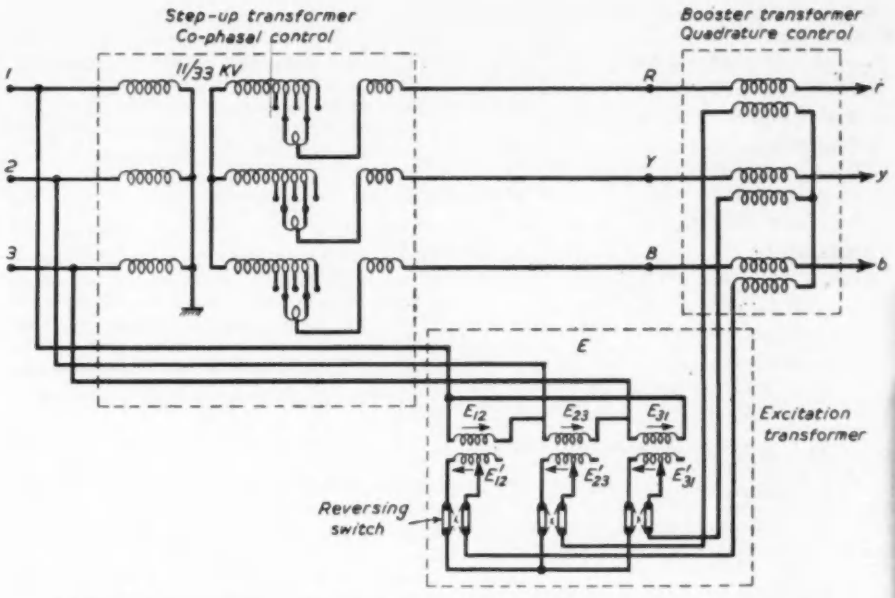

Fig. 3.—Diagram of connections of in-phase and quadrature voltage regulating equipment

Feeder currents:

$I_{1T}=297{\cdot}3\angle 0{\cdot}8^\circ \qquad I_{2T}=334{\cdot}1\angle 68{\cdot}2^\circ$

Voltage drop:

$e_1=I_{1T}\angle 0{\cdot}8^\circ \times Z_1\angle 49{\cdot}5^\circ$
$=297{\cdot}3\angle 0{\cdot}8^\circ \times 0{\cdot}63\angle 49{\cdot}5^\circ=188\angle 48{\cdot}7^\circ$
$e_1=124+j\,141$ volts

Sending end phase voltage:

$E_s=6{,}350\angle 0^\circ+124+j\,141=6{,}474+j\,141$
$E=6{,}475\angle 1{\cdot}3^\circ$

Load distribution:

$P_{1W}=5{,}660$ kW $\qquad P_{1R}=80$ kVAR
$P_{2W}=2{,}350$ kW $\qquad P_{2R}=5{,}915$ kVAR

(*c*) Two voltages, in-phase and quadrature components representing the impedance voltage drop in feeder (2) are injecting separately into the 33 kV circuit. With this boost voltage (see Case (a) $e_b=266\angle 18{\cdot}9^\circ$ V), we obtain the following values:—

Circulating current:

$$I_c=\frac{266\angle 18{\cdot}9^\circ}{Z_{12}\angle 72{\cdot}4^\circ}=93{\cdot}5\angle 53{\cdot}5^\circ=55-j\,74{\cdot}5\text{A}$$

Feeder currents:

$I_{2T}=I_2\angle 59{\cdot}7^\circ+I_c\angle 53{\cdot}5^\circ=208\angle 56{\cdot}9^\circ$
$=114-j\,174$ A

$I_{1T}=I_1\angle 30{\cdot}6^\circ-I_c\angle 53{\cdot}5^\circ=338{\cdot}5\angle 24{\cdot}5^\circ$
$=308-j\,140{\cdot}5$ A

Voltage drop:

$e_1=I_{1T}\angle 24{\cdot}5^\circ \times Z_1\angle 49{\cdot}5^\circ=214\angle 25^\circ$
$=194+j\,89{\cdot}5$ V

Sending end phase voltage:

$E_s=6{,}350\angle 0^\circ+194+j\,89{\cdot}5$
$=6{,}544+j\,89{\cdot}5=6{,}544\angle 0{\cdot}8^\circ$ V

Load distribution:

$P_{1W}=\sqrt{3}\times 11\times 338{\cdot}5\times 0{\cdot}91=5{,}835$ kW
$P_{1R}=\sqrt{3}\times 11\times 338{\cdot}5\times 0{\cdot}41=2{,}660$ kVAR
$P_{2W}=\sqrt{3}\times 11\times 208\times 0{\cdot}55=2{,}170$ kW
$P_{2R}=\sqrt{3}\times 11\times 208\times 0{\cdot}84=3{,}330$ kVAR

Obviously the load control is more flexible when the injected voltage is adjusted in magnitude and phase. Although feeder (2) picks up only $2{,}170\times 100/8{,}000=27\%$ of the total power, the load sharing is improved (see Table) when applying in addition to in-phase quadrature boosts.

The boost voltage for equal sharing of kilowatts and kilovars between the two feeders is obtained as follows:—

Line currents with zero boost voltage (see Case (a)):

$I_1=363-j\,215$ A $\qquad I_2=59-j\,99{\cdot}5$ A

Required total line currents when applying boost voltage:

$I_{1T}\cos\Phi_1 = I_{2T}\cos\Phi_1 = \frac{1}{2}\,8{,}000/\sqrt{3}\times 11 = 209\text{A}$

$I_{1T}\sin\Phi_1 = I_{2T}\sin\Phi_2 = \frac{1}{2}\,5{,}990/\sqrt{3}\times 11 = 157\text{A}$

$I_{1T} = I_{2T} = 209 - j\,157 = 261{\cdot}4\angle 36{\cdot}8^\circ\ \text{A}$

Circulating current:

$I_c = I_{2T} - I_2 = 209 - j\,157 - (59 - j\,99{\cdot}5)$

$= 152 - j\,57{\cdot}5$

$I_c = 164{\cdot}5\angle 20{\cdot}7^\circ\ \text{A}$

Alternatively:

$I_c = I_1 - I_{1T} = 363 - j\,215 - (209 - j\,157)$

$= 164{\cdot}5\angle 20{\cdot}7^\circ$

Boost voltage referred to 11 kV:

$e_b = I_c\angle 20{\cdot}7^\circ \times Z_{12}\angle 72{\cdot}4^\circ$

$= 164{\cdot}5\angle 20{\cdot}7^\circ \times 2{\cdot}85\angle 72{\cdot}4^\circ = 470\angle 51{\cdot}7^\circ\ \text{V}$

$e_b = 289 + j\,365 = 4{\cdot}55\% + j\,5{\cdot}8\%$

Check: Currents are equal in magnitude and phase if the injected boost voltage is equal to $(e_2 - e_1)$ in phase and magnitude.

Voltage drop:

$e_1 = I_{1T}\angle 36{\cdot}8^\circ \times Z_1\angle 49{\cdot}5^\circ = 261{\cdot}4\angle 36{\cdot}8^\circ$

$\times 0{\cdot}63\angle 49{\cdot}5^\circ = 165\angle 12{\cdot}7^\circ =$

$162 + j\,36{\cdot}3\ \text{V}$

Voltage drop e_2:

$e_2 = I_{2T}\angle 36{\cdot}8^\circ \times Z_2\angle 78{\cdot}6^\circ = 261{\cdot}4$

$\angle 36{\cdot}8^\circ \times 2{\cdot}285\angle 78{\cdot}6^\circ = 600\angle 41{\cdot}8^\circ$

$= 448 + j\,400\ \text{V}$

Boost voltage referred to 11 kV:

$e_b = e_2 - e_1 = 448 + j\,400 - (162 + j\,363{\cdot}3)$

$= 287 + j\,364 = 470\angle 51{\cdot}7^\circ$

When comparing the values given in Table 1, we realise that load control by ratio changing on the main transformer has little effect on the sharing of the power between the two feeders. The injected in-phase voltage increases the reactive power in the 33 kV line considerably and controls mainly the reactive power flow.

On the other hand, quadrature boosts control the power flow and improves the distribution of the power. Ideal conditions (equal power sharing) are obtained by adjusting both in-phase and quadrature boost voltages and making e_b equal in phase and magnitude to the difference of the voltage drop $(e_2 - e_1)$. The value of e_b depends on line constants, kilowatts and power factor required by the load.

Circuit Arrangement

Control of the sharing of kilowatts and kilovars in the transmission system outlined in Fig. 1 is not only an electrical but an economical problem. Since booster transformers for phase angle control are very expensive, consideration should be given in the first place to a reactor inserted in the 11 kV feeder, provided the system voltage is kept within the statutory limits.

Equal kilowatts and kilovars distribution is secured with a reactor of the impedance $(Z_2 - Z_1) = 0{\cdot}451 + j\,2{\cdot}24 - (0{\cdot}41 + j\,0{\cdot}48) = 0{\cdot}04 + j\,1{\cdot}76$ ohms.

A scheme based on separately controlled co-phasal and quadrature voltages is shown in Fig. 3. The in-phase voltage is obtained by ratio changing on the existing step-up transformer. The tapped part of the winding is in the centre of each phase on the h.t. side and not on the l.v. side, and the mid-point tapped reactor reduces the number of tappings. With this arrangement we obtain large voltage variation within close percentage limits.

The quadrature regulation lagging or leading is achieved by a separate series booster (B) in conjunction with the exciting transformer (E) connected on the primary side in delta and on the secondary in star.

By varying the tappings of the h.t. windings of the main transformer we increase the phase voltages in magnitude from E_1, E_2, E_3 to E_R, E_Y, E_B and the added voltages will be in phase with the original vectors, as illustrated in the vector diagram (Fig. 4a).

TABLE 1

Boost Voltage		Load			Feeder 1					Feeder 2				
In-phase	Quadrature	Power	Reactive Power	p.f.	Power		Reactive Power		p.f.	Power		Reactive Power		p.f.
		kW	kVAR	lag.	kW	%	kVAR	%	lag.	kW	%	kVAR	%	lag.
zero	zero	8,000	5,990	0·8	6,900	86·1	4,083	68·0	0·86	1,110	13·9	1,908	32·0	0·5
4%	zero	8,000	5,990	0·8	6,385	80·0	2,480	41·5	0·93	1,620	20·0	3,510	58·5	0·42
10%	zero	8,000	5,990	0·8	5,660	71·0	80	1·34	0·99	2,350	29·0	5,915	98·66	0·37
4%	1·33%	8,000	5,990	0·8	5,835	72·5	2,660	45·5	0·91	2,170	27·5	3,330	54·5	0·55
4·55%	5·8%	8,000	5,990	0·8	4,000	50·0	2,995	50·0	0·80	4,000	50·0	2,995	50·0	0·80

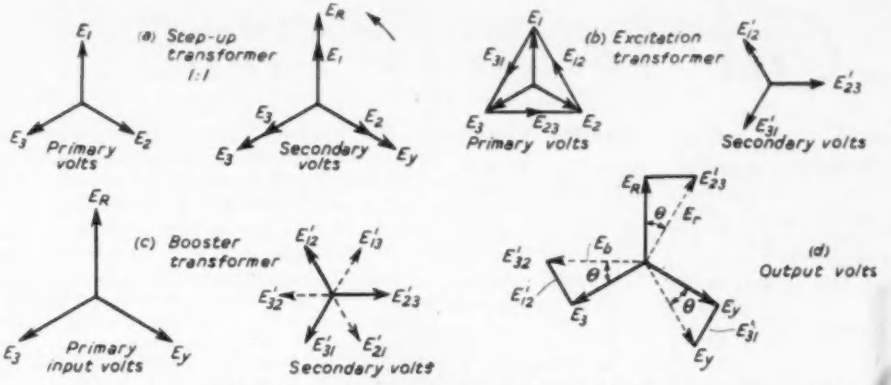

Fig. 4.—Vector diagram illustrating the relationship between system in-phase and quadrature voltages for the circuit

The phase control between the input voltages E_R, E_Y, E_B applied to the booster and output voltages E_r, E_y, E_b (Fig. 4d) required to increase the kilowatts in feeder (2) is obtained by means of the booster transformer (B). By associating the red phase voltage with a lagging secondary voltage E_{23}^1 obtained from the secondary of the excitation transformer, yellow phase voltage with E_{31}^1 and blue phase voltage with E_{12}^1, the added voltages in quadrature with E_R, E_Y, E_B will shift the latter by an angle θ. The vectorial relationship is shown in Fig. 4d. It is seen the phase shift angle θ between input and output voltages depends on the magnitude of the injected quadrature component, e.g. for $E_{23}^1 = 5\ E_R/100$ will produce a phase shift $\theta = \tan^{-1} E_{23}^1/E_R = 2{\cdot}9°$.

In similar manner the input voltages are shifted in clockwise direction by associating leading quadrature voltages with the input vectors E_R, E_Y, E_B. This is achieved by reversing the star point of the exciting transformer (E) by means of reversing switches.

Thus control of the power and power factor in each feeder is secured by varying the injected in-phase and quadrature components of the boost voltage and the phase angle of the boost voltage in the feeder with larger impedance.

But it will not always be economically justified to employ the very expensive quadrature booster in addition to step-up and step-down transformers. Flexibility of the quadrature component is in some cases not necessary. Boost voltages at fixed angle provided by one tap-changing transformer can be provided more cheaply. In this case both components, the in-phase and quadrature component, are adjusted simultaneously.

For instance, boost voltages at fixed angle of 60° can be obtained by placing the main winding on one limb and the tapped portion of this winding on another limb. Each 2% of boost at 60° will produce 2 cos 60° = 1% of in-phase boost and 2 sin 60° = 1·73% of quadrature boost.

Conclusion

Equal loading of parallel feeders with dissimilar characteristics is impossible unless voltage regulating devices are incorporated in the feeder with the larger impedance. When applying in-phase boost only, the consequent circulating current increases the reactive power in the 33 kV feeder, decreases the kilovars in the 11 kV feeder and will not influence the sharing of the power if the reactance of the loop circuit is considerably large as compared with the resistance.

On the other hand, in-phase and quadrature boost voltages injected separately give the most flexible operation.

Boost voltages at fixed angle (both components are applied simultaneously) will give satisfactory load control if approx. power sharing between the two feeders is an acceptable solution.

Finally, adding resistance and reactance to the 11 kV circuit is an alternative solution, and the extra voltage drop could be compensated by employing a series booster if it is economically justifiable.

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O. HORWARTH: "Control of Voltage and Power Factor on Interconnected Systems." I.E.E. Journal 1935 Vol. 76 p.353.

"Urban Transmission Problems": ELECTRICAL TIMES, August 5, 1949.

Our readers' views . . .

Deptford in the Nineties

WHILST remaining impressed by Mr. A. C. Eborall's authorities, I would direct his attention to a report by Dr. J. A. (later Sir Ambrose) Fleming on the tests made on the Ferranti installation on January 9, 1891.

This appears in the *Journal I.E.E.*, Vol. xx, p. 389, and gives the alternator voltage as 2,400 at 52 r.p.m., and frequency 83.

E. H. Jesty,
A.M.I.E.E.

BROMLEY, KENT.

◆ ◆ ◆

Commercial Engineers

"CONSUMERS' Engineer," in his letter which was published in the ELECTRICAL TIMES of March 23, makes the complaint that during negotiations for a new agreement on salaries in the supply industry, the consumers' engineers were virtually unrepresented as so few of them were members of the E.P.E.A. Surely this points to the fact that the majority of "consumers' engineers" are either not engineers or that they do not know how to get the best conditions by organising. If this is true then they do not know how to sell themselves and would hardly be the best people to sell electricity.

It is not certain that consumers' and distribution engineers are both *equally* necessary for the efficient working of a supply undertaking. Consumers' engineers are not absolutely necessary, but I cannot visualise an undertaking without a distribution engineer.

There is an entirely different outlook between the two; one is biased in favour of immediate sales of apparatus and quick profits, while the other is concerned with providing an adequate supply of electricity and with encouraging consumers to make full use of the service he has to offer. The distribution engineer managed to increase the sales of electricity during the early years when the industry had to fight for supremacy against intense competition and more severe handicaps than it is experiencing at the present time.

I am not sure that the consumers' engineers would fare so well as regards making profits if the supply side of the industry did not bear more than its fair share of costs.

The distribution engineer is compelled by law to provide an adequate supply in a given time in some instances, but there is no corresponding obligation on the consumers' engineer.

If a consumers' engineer makes a mistake he can do some rubbing out, but if a distribution engineer makes a mistake he or one of his colleagues is likely to be rubbed out.

"*Carry On*"

HERTS.

(Owing to pressure on space, a considerable correspondence on this subject has been held over till next week.—Ed.)

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Industrial Power

IN Mr. Woodfall's article on the economics of Diesel Generation, I was rather surprised to see that he raises the old bogey of low thermal efficiency of coal burning power stations and the loss of valuable by-products from the fuel used which he also says might otherwise be exported in "considerable quantities."

Mr. Woodfall evidently assumes that the coal used by power stations is suitable for carbonisation and the recovery of by-products. This is not true, neither has it much of an export value. The electrical industry admits that it has to waste 70-75 per cent. of the available thermal units in the fuel it uses, but can Mr. Woodfall point to any other process which makes better use of this kind of coal?

Philip Honey

E.D.A.

◆ ◆ ◆

I WAS very interested in the article in your issue of March 16, entitled "Industrial Power—Public or Private?" by Mr. D. Woodfall. It is a very able survey of the position. There are, however, two points which you might care to bring to Mr. Woodfall's attention. In Table B he mentions a 27 b.h.p. two-cylinder horizontal engine. This, I think, should be one-cylinder, because there are no two-cylinder horizontal engines of that h.p. made at present. All four engines in that table are in the Brush group, I imagine, and if he is referring to the Petter-Fielding horizontal engine, it should be a single-cylinder type.

At the top of page 405 occur the following words: "The new cost of pool gas oil (October, 1949) is 11d. per gallon plus 1d. duty." The 1d. duty for industrial diesel fuels was abolished several years ago.

D. S. W. Williams

"THE OIL ENGINE AND GAS TURBINE." Editor

Aluminium Pressure Cable

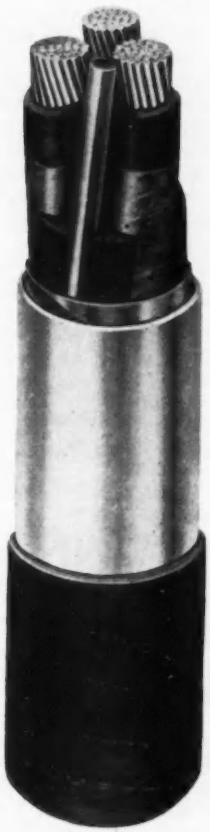
New B.I.C.C. Development for 33 kV

LATEST addition to the range of aluminium-sheathed cables manufactured by British Insulated Callender's Cables Ltd. is a 33 kV impregnated pressure type. This is now being manufactured in 330 yd lengths, and installations are being carried out for Area Boards of the B.E.A.

Application to pressure cables is encouraged by the increased mechanical strength of aluminium. The sheath of an impregnated pressure cable is required to withstand an internal nitrogen gas pressure of 200 lb. per sq in. and when lead is used it is necessary to provide external steel reinforcement. This is unnecessary when an aluminium sheath is used, and a further saving in weight and cost is thereby achieved, although the wall thickness of aluminium sheath will not be less than 90% of the corresponding lead sheath.

Corrosion of aluminium in a buried condition is no greater a hazard than when using lead and steel reinforcement, and the normal rubber-bitumen sandwich serving is applied as protection. Long time tests in heavily concentrated acid and alkaline soils have proved the efficiency of this serving as a corrosion protection.

Satisfactory hand plumbing to the aluminium sheath was a major problem which has been successfully overcome, and a technique has been developed which enables internal pressures of 1,000 lb. per sq in. to be withstood for long periods without failure. It is of note that in view of the omission of reinforcing tapes, the joint design is considerably simplified in that the cast plumb—used with a normal lead sheathed joint—is omitted, with a resultant saving in cost and jointing time.



Sheath Application

Considerable investigation has been carried out into the most convenient method of applying the aluminium sheath. The two methods which have progressed most are the welded-seam tube and the died-down sheath. The first method presents difficulties of a practical nature in its application to pressure cables and research is still in progress on this technique. The dieing-down method has been adopted as the only practical means at the moment for producing a seamless sheath. The cable is first drawn into an oversized tube, and both cable and tube are pulled through a "sinking" die which reduces the outside diameter to the required figure. Generally, the reduction in diameter is confined to a maximum of 30%, but this figure can be increased for tubes of below approximately 1 in. outside diameter.

Aluminium-sheathed cables are lighter than similar lead-sheathed types and because of the increased mechanised strength of the sheath do not normally require armouring. This saving in weight reduces bulk transport costs and enables fewer men to handle installations; fewer supports are required when the cable is installed above ground.

The mechanical properties of aluminium are far superior to those of lead for cable work. It is particularly advantageous in respect of fatigue endurance, and on this account it is unnecessary to take any special precautions for aluminium-sheathed cables installed in positions where vibration is severe. Although they are not quite so flexible as corresponding lead types, no undue difficulties in installation are encountered.

Testing

In addition to the routine tests laid down in the C.E.B. specification C 1947, many long time stability tests, accelerated ageing tests and impulse voltage tests, have been carried out.

COSTS CAUSE CONCERN TO E.L.F.A. MEMBERS

Trade Discount is Lowered

"RISING costs are causing the greatest concern to all members," said Mr. F. W. Norris, presenting the Electric Light Fittings Assocation's annual report on Wednesday of last week. Mr. Norris commented that the recent sharp rise in the cost of non-ferrous metals consequent upon devaluation made the problem even more acute. Any further increase in costs would make some advance in the price of fittings inevitable.

Of general business trends, Mr. Norris said the summer level of business during 1949 was higher than the corresponding period in 1948. Although figures were not available for the last quarter of 1949, it was anticipated that the figures bore a very fair comparison with the previous year. He drew attention to an increase in the value of educational buildings under construction, indicating a satisfactory demand for lighting fittings for new school buildings.

E.L.F.A. is collaborating closely with officials responsible for the lighting of the various centres for the Festival of Britain. An E.L.F.A. panel has been set up with the approval of Festival Authorities to review any lighting fittings tentatively selected for exhibition. Another panel is advising on illumination.

Continued operation of price control orders during first half of the year, continued Mr. Norris, prevented the introduction of a reduced basic trade discount and certain other revisions of the Decorative and Commercial Section's trading policy. Withdrawal of price control orders on fittings in July enabled work to begin again on plans for the revised discount structure.

A new detailed code incorporating a basic trade discount of 25% (instead of 33⅓% as at present) had already been agreed to by Associations representing the distributors and the Electrical Fair Trading Council. The revised discounts permit lower retail prices for the benefit of the consumer, and it was hoped the new code would be introduced shortly.

Both the Industrial Fittings and Street Lighting trading codes were extended and amended during the year.

Building and Civil Engineering Work Completed
(Ministry of Works Figures)

	£ million						
	1948 quarter				1949 quarter		
	1	2	3	4	1	2	3
Factories and industrial premises ...	21	23	23	22	19	21	22
Storage, warehouses and docks	1	2	2	2	1	2	2
Construction of permanent houses...	67	58	54	53	51	54	55
Shops and commercial premises	5	7	7	7	7	8	7
Hospitals, schools and universities	5	6	7	7	7	7	8

E.L.F.A. Annual Luncheon

ENLARGING the size of the family circle was the introduction to Mr. F. W. Norris's speech at the annual luncheon of the Electric Light Fittings Association when, as President of the Association, he proposed the toast of "The Guests." It was, he said, the first time that E.L.F.A. had gone outside its immediate family circle, but this time he was glad to welcome representatives from the Electrical Contractors Association, the Electrical Wholesalers' Federation, the Electrical Fair Trading Council, the Electric Lamp Manufacturers' Association, and the Electric Discharge Lamp Auxiliaries Council. In addition, they had their first President, Mr. J. N. Stephens, with them.

E.L.F.A., he felt, had been far too little known, although it was in its twenty-fifth year, having been founded in 1926. Nevertheless, they had a very real sense of satisfaction in seeing the results of their efforts in service everywhere, and he hoped that the day would never come when a manufacturer did not take a pride in his products.

For Mr. J. M. Hollander, who replied, it was an occasion—his maiden speech as President of the Electrical Wholesalers' Federation. Those present represented the four-fold branches of the tree of the electrical industry—manufacturer, wholesaler, contractor, and fair traders' policy, and only by presenting a united front could they stand up to nationalised industries, monopoly commissions, planners and controls, and confront the forces which tended to overthrow all which had patiently been built up. He reminded his listeners of the traditional bundle of faggots which could so easily be broken independently but not as a bundle, bound by a cord of mutual understanding and goodwill which must not be loosened.

Mr. S. Dickinson (President, E.C.A.) also replied, expressing thanks for the goodwill and real understanding which had existed between their Associations.

"The Past Presidents" was proposed by Mr. K. Scott Adie, in an amusing speech. Mr. F. Winstanley (Director, G.E.C.) made suitable reply, in which he regretted the absence of Mr. Felix Rogers, to whom was dispatched a telegram of goodwill and wishes for a speedy recovery.

Notes on Wiring
by MEGOHM

Multiway 13-amp Sockets

Some Observations on the Adaptor Problem

I HAVE read with interest the view expressed by various correspondents who favour multiway adaptors for use in connection with the all-purpose socket outlets. One firm, I notice, now have these in production, whereas another manufacturer has abandoned this expedient, but is developing a "small device" to serve the same purpose.

For what it may be worth, I must confess that I abhor anything in the nature of adaptation, in the sense that something is altered or converted so as to perform a function for which it was not originally intended. Granted, that the usefulness of some article can on occasion be extended by making some slight alteration to the original design, but that is not the same thing as multiplying the outlets from a socket, by plugging in one or more multiway adaptors.

Sufficient Outlets Required

Before the last war, the E.D.A. and others sponsored a campaign, with the object of educating the public, so that the then standard of two or three sockets per house would no longer satisfy their requirements for an efficient and complete electrical installation. As a result we had the 2-, 5- and 15-amp sockets and eventually, after much deliberation and strife, we arrived at the 13-amp all-purpose socket-outlet which the sponsors firmly hoped would solve all our troubles.

If properly installed, I cannot see any reason why adaptations should really be necessary. Essentially the 13-amp socket was intended for domestic use, and the whole crux of the matter is that it should be installed in sufficient numbers, and in suitable positions, if the results are to be satisfactory. Here the feminine point of view must be taken into consideration. For some, to me, quite inexplicable reason, some otherwise delightful members of the opposite sex have a recurring, irrepressible desire to rearrange the furniture in a room at uncertain intervals; and peculiarity must be catered for.

Looking back to the time when the 13-amp socket was first standardised, I find that I reviewed the specification on July 10, 1947, and had a special article the following week, in which the suggested layout for ring-main circuits in two types of houses were illustrated and discussed in detail. At that time costs were not available, but on February 5, 1948, Mr. J. Crisp gave comparative costs for the socket wiring, in a three-bedroom type of modern house, which showed that fourteen 13-amp sockets were cheaper to install than six 2-amp, one 5-amp and seven 15-amp, which would give roughly the same facilities. Our allocation, arrived at quite independently, was more or less the same, as I had preferred to leave the kitchen, larder and water-heater off the ring circuit, thereby arriving at a total of nine sockets for a house of this type.

Ganged Outlets Suggested

If we examine this matter in slightly more detail, we find that the earth pin of a 13-amp plug top projects 0·92 in. from the body, the body is approx. 0·75 in. deep, and the cover, say, 0·15 in., giving a total of 1·8 in. for the plug-top alone. It will be seen, therefore, that with an adaptor, for which we must allow two thicknesses of insulation plus clearance for the pins, the total projection must be at least 2 in. on sunk work, and will probably be 3½ in. or more on surface work. This is surely both cumbersome and unsightly, and must put an extra strain on the socket proper, for which it was never designed.

A better solution to the problem, if we decide to cut down on the number of outlet positions, is surely to provide two or even three outlets fitted in the same box, and mounted on one cover-plate. Today's list price is about 6s. 6d. for a flush type socket in a metal box, and therefore a 2-gang unit could presumably be listed at, say, 11s. If made as one unit, the fitting costs would be the same and no extra wiring would be required. A 3-gang assembly should not cost more than 15s.

Finally, I would like to see a general design adopted whereby the colour of the cover-plates could be changed without much bother, so as to fit in with any change in the decorations of a room. Brown may be a good utility colour, but others are more pleasing to the eye.

A.C. Network Problems

Some experience of operating British network analysers described in I.E.E. Supply Section paper

THE need for network analysers to solve problems associated with large distribution systems did not arise in this country until just before the last war, although the necessity for this technique had arisen in America many years before. This was mainly due to the problems which arose in the running of generating stations, many miles apart, in parallel.

Although two analysers had been constructed prior to the war and were in regular use (the Blackburn Analyser and a d.c. analogue analyser at Bankside), no analysers similar to those developed in America were available until the A.E.I. machine at Willesden came into operation some two years ago.

Details of the construction and operation of this machine were given last week to the Supply Section of the I.E.E. by Mr. G. Lyon in his paper "Some Experience with a British A.C. Network Analyser."

Problems to be Solved

The problems requiring solution fell into two main groups, one of which contained normal-frequency occurrences and related matters, and the other relatively high-frequency phenomena such as surges and local resonances. The second group was not dealt with in the paper. In turn, the first group could be subdivided into four sections: (1) loading conditions which involved the distribution of voltage and active and reactive power over a system; (2) stability studies to ensure machines remaining in synchronism; (3) investigations into maximum values of fault current in networks to ensure the correct rating and application of circuit-breakers and protective gear, and (4) miscellaneous problems such as communication interference and the distribution of audio-frequency voltage such as is used in ripple-control schemes.

Analyser Components

The analyser under consideration (which was briefly described in our issue of November 6, 1947), consisted of an assembly of passive elements, power sources and interconnectors. Basic values of 500 c/s with a nominal current of 50 mA and a voltage of 50 V were chosen. The reason for the higher frequency was to simplify amplifier design and to enable smaller components to be used. The supply was provided by a motor-generator set controlled by electronic regulators to within $\pm 0{\cdot}2\%$ of the nominal voltage and frequency. All the dials and instruments were calibrated in percentage impedance, voltage, etc., as normally all systems were set up on the equipment in terms of the familiar percentage impedances computed to an appropriate MVA base. This had the added advantage of automatically reducing a multi-voltage system to an equivalent single-voltage circuit and so removed many awkward multipliers from the detailed working. The less familiar per-unit method had certain additional advantages and its increasing use was to be commended.

The elements consisted of 12 generators, 120 lines (series impedance), 30 π-line facilities, 30 loads (shunt impedance), 60 capacitors, 36 auto-transformers, 12 coupling transformers ratio 1:1, 2 coupling transformers ratio 1:2 and 2 coupling transformers ratio $1:\sqrt{3}$. Connections to these elements were brought out to a plug board, similar to a telephone jack board. Metering facilities were provided to give readings of current, voltage across the circuit unit or from a neutral busbar, phase angle of any of these quantities relative to any arbitrary reference and active and reactive power at either terminal. The meters were powered through valve amplifiers to reduce the burden on the system.

The paper continued by giving some typical examples of load studies on various systems and gave details of the procedure adopted for them.

Simplification

Many power systems were too large to be studied in full at once, either because of inconvenient detail or because of limitations in the model apparatus. It was always advantageous to make certain simplifications, but in some cases it was necessary to carry out extensive reductions. For example, in the British grid, it was only feasible to study a small portion at one time, and valid equivalents for the remainder of the network had to be derived.

Generators connected to the same busbars could be represented by one equivalent machine, the reactances being paralleled and

the inertia summated. Sections of stations connected by inter-bus reactors or transformers could be lumped if the impedance between busbars was small compared with the system impedance, as in a transmission system, but the sections must usually be separately represented if the inter-bus impedance was considerable as in distribution and many sub-transmission schemes.

When making load studies on the analyser, it was possible to economise in apparatus in the latter case, by connecting one generator unit to two generation busbars through two impedances so adjusted as to share the total generation in the required proportion.

Great difficulty arose in deriving a satisfactory equivalent to use in load and stability studies where there were several ties between networks and several methods had been propounded to deal with this. Probably the best was one due to Ward and was superior to those previously available.

It was emphasised that care had to be taken in establishing a recording system, as the speed at which the analyser made results available was such that a week's work could produce many thousands of readings. For load studies, tabulation was useless except in the simplest cases, and the method most used was to record results directly on a copy of the system diagram. In such studies, readings could be made at the rate of four or five hundred per hour—about as fast as they could be recorded satisfactorily.

It was also important to have a quick means of conversion of symmetrical component readings into phase quantities, and in this connection the Wardrop vector computor which did a vector addition electrically was a great help.

In conclusion, it was pointed out that two years' experience with the analyser had confirmed the view that it was an indispensable instrument in the planning of power systems. Furthermore, it was possible on a working model system, to carry out all kinds of experiments which it would be unwise to try out on an actual system, and the sequence of events could be stopped at any time and examined at length. In this way it was possible to educate people to gain a sense of how power systems behaved.

DISCUSSION

Mr. M. W. Humphrey Davies (Imperial College), who opened the discussion, emphasised the value of the network analyser for training operating staff. No serious network analyser study, he said, should be undertaken without at least one member of the control room staff being present throughout. Not only would the control engineer have the opportunity to try out some of the things that he would like to do, if need arose, on the actual system, but he could help to solve problems which arose during the study.

From his own experience of network analysers he felt certain that there was nothing better than the analyser described in the paper. He suggested that whenever a system was set up on a network analyser a measurement should be made for all likely operating conditions of the driving point and transfer impedances of the network, viewed from the different generators. If it were then found, after a study had been completed, that it was desirable to introduce some slight modification to the scheme, it could be dealt with by using computing machines.

Dr. E. Bradshaw (Manchester College of Technology) said that while in a commercial analyser speed of operation was probably the overriding consideration, it might be worth considering the use of variable elements for line load units which were controllable in fairly coarse steps and not calibrated, the fine control between the steps being obtained by an auto-transformer and using an a.c. bridge against which each unit could be set up in turn.

Dr. J. R. Mortlock (B.T.H.) referred to the assumptions which were a feature of analytical methods, and emphasised the need to remember, when looking through the answers, the premises on which they were based. It was easy, he said, to devise a procedure, become familiar with it, and later to forget the original assumptions and use it for some other application, ending up by using it fallaciously, as in the case of a procedure developed for load studies and then extended to transmission, where the problems were very different.

Mr. W. T. J. Atkins (B.E.A.) said it was very comforting to the supply engineer, whether concerned with design or with operation, to realise that he had behind him equipment of the very versatile kind described. Working on an analyser gave an insight into the operation of a system which might even be superior to that obtained by operating on the system itself. It was usual to work out in detail the consequences of the assumptions underlying stability studies, but he would like to have concrete evidence based on service experience and to found his speculations on such data rather than on the somewhat abstract notions which were behind a good many of the published theories.

Mr. E. B. Powell agreed with the Author that when dealing with extensive networks the a.c. analyser was the only reasonable way of tackling the problem, but said that there were cases, especially in this country, on fairly compact networks, where problems could be attacked by the use of the d.c. board or by calculation. Where it was desired to examine a large number of conditions, taking a couple of days, the a.c. board had the advantage, because the few hours spent in

getting a balance between sinks and generation did not matter, but where a problem was thrown at someone and the answer was wanted in four or five hours, the d.c. board was to be preferred.

DR. B. ROSTON (E.R.A.) said that in the a.c. network analyser which the E.R.A. were making they were departing from the operating frequency normally adopted, and in the pilot model which they had built they adopted a base frequency of 1·6 kc/s. The adoption of this higher frequency and of a much lower current base and voltage base made it possible to use components of a type used in communication engineering, resulting in a considerable saving in bulk and cost for a given accuracy. Components of this type could maintain a satisfactory accuracy over a wide frequency range, so that it should be possible to use the analyser not only on steady state but also on transient and harmonic and multiple-frequency problems. It seemed to him that the Blackburn analyser would have interesting possibilities if it proved to be as accurate as and not more expensive than the conventional type, and if certain refinements could be introduced.

MR. G. W. MAXFIELD, speaking as one who for many years had to carry out load dispatching, suggested that the network analyser should be reserved for tasks which could not be dealt with by calculation, so as to relieve the demand on it. Steady state load dispatch problems in this country, where the system was compact and generation fairly evenly distributed, enabled many assumptions to be made legitimately, and for some time past he had used a method of calculation which should relieve the network analyser of many of its tasks, and by which much of the work could be delegated to the clerical staff.

MR. W. D. WORTHY (E.E.Co.) said that one of the outstanding contributions which machines of the type described could make to the preliminary study of design problems arose from the ease with which alternatives could be tried and the variations in a desired result due to uncertainties in initial data investigated. In the limited experience which they had had with the analyser recently brought into commission at Stafford, they had already met the difficulty to which the author referred due to the dearth of British data on machine characteristics.

MR. K. W. WARDROP (A.E.I.) emphasised that the analyser was a tool and nothing more. The accuracy of the results depended on the accuracy of the asumptions, and a good deal of correlation with practice was required. On load studies, very good agreement had been obtained with actual readings on various networks. About fault studies they were not so confident, not having had so many results. With regard to transient stability studies, there had been no real tests in this country on which to draw, and there was great need for co-operation in checking the results obtained.

The Author briefly replied.

The A.E.H.A. "Arrives"

KEYNOTE of the speeches at the annual dinner of the Association of Electrical Housecraft Advisors' third annual dinner was a sense of satisfaction with achievement made, coupled with a determination to progress even further in the future.

Replying to the toast of "The British Electricity Authority," proposed by Miss Marjorie Gordon, B.Sc., Mr. E. W. Bussey said he and his colleagues had spent the last 2½ years in moulding the personnel of the nationalised industry into a homogeneous body, and tying up loose ends. Negotiations might have seemed long drawn out but the problems which the B.E.A. inherited had been in existence for many years. Last week, an agreement had been signed by which every demonstrator housecraft adviser and showroom assistant came under a definite scale and the raised status of the housecraft adviser would attract newcomers outside the industry. He paid a tribute to Dame Caroline Haslett for her fight for the cause of women in the electrical industry.

Mr. H. J. Randall, F.C.I.S., C.I.E.E., in proposing the toast of "The Association," emphasised the importance of the housecraft adviser as a liason officer between Area Boards and the consumer. Their Association did not exist only for improvement in salary and working conditions, it was making them more aware of their rightful place in the scheme of things. Ours was a great industry with infinite possibilities in which the housecraft adviser could play an important part.

Wider Outlook

Dame Caroline Haslett, D.B.E., replying to the toast, emphasised the importance of fitting themselves for higher things. They could play a part of increasing importance in the industry, but they must widen their horizons. Important as was their work of advising housewives, they should take more of an interest in great affairs such as town planning, and public health, and try to introduce new thought into their task of spreading the use of electricity, regarding it not merely as a means of performing a household task but as a potent force for the benefit of humanity.

Tribute was paid to the indefatigable work of the chairman, Miss M. G. Gosse, by Miss Joan Whitgift in an original approach to the toast of "The Guests." Mr. E. R. Wilkinson, M.I.E.E., M.I.Mech.E., in his reply, stressed the importance of the members of the Association in competing for the cooking load. Their first job was to concentrate on that particular field.

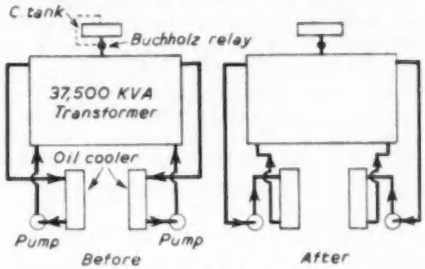
About one hundred members and guests attended the dinner, which was held at the Charing Cross Hotel. Dame Caroline Haslett, as president of the Association, was in the chair.

Problems and Practice

IN ENGINEERING

Transformer Cooling Troubles

A MACHINE step-up transformer, 11 kV-66 kV, was equipped for forced oil cooling as shown in first sketch. After the first few days in service, the Buchholz alarm commenced operating and each time a check showed that air was present in the alarm chamber. The pump glands were repacked and all valve glands were also examined and found correct. With a view



Pipe arrangements for forced oil cooling

to keeping the machine on load and still leaving the trip portion of the relay effective, a small pipe was led from the vent of the Buchholz alarm chamber to the conservator tank and the air allowed to escape that way. After several months of investigation it was at last discovered that the air was getting in through a grease cup fitted to lubricate the internal bearing on each pump. This was due to the fact that the oil coolers provided a slight restriction in the pump suction, due again to the pipework arrangement. When the latter was altered as shown in the second sketch the air intake stopped, and there has been no further trouble. —*H. T. W.*

Simple Tool Protects Cables

HAVING to wire mains for a heating load of considerable size, I found the main conduit run had been fitted with an inspection bend, in angle of 90°. Pulling the cables against the edge of the fitting was certain to damage the braiding, so a simple tool was made which overcame the difficulty with remarkable success.

A 1 in. batten, fitted with a 2½ in. reel insulator near the end allowed the cables to run easily around it, and prevented all risk of damaged hands whilst pulling in cables, as can often happen.—*Hugh Mitchell.*

The Phantom Fault

FOR some months after a new house had been wired by a well-known firm of electrical contractors a small back bedroom was not used. One evening, the light had been switched on for half an hour or so when the circuit fuse blew. The fuse was renewed, and the light again switched on. Everything was satisfactory, until about half an hour later when the fuse blew again.

The circuit was "Meggered" and the test showed "no fault," yet the whole sequence was repeated on one or two subsequent evenings with the same result. The writer was truly baffled. What next?

The circuit was taken from a joint box in the roof. An inspection here was decided upon. At first nothing could be seen, but a closer investigation revealed a small burn hole in the insulation on the top side of a conductor. This led to an inspection of the two screws used for securing in place the junction box cover. One was short and one long, and it was found that the latter was burned at the end. Being without the correct short screw, the electrician had used the long one. This was of a length sufficient to reach and pierce the insulation of the live conductor. The original earth fault had burned (a) a small hole in the insulation; (b) the end of the screw; and (c) the surface of the bare conductors.

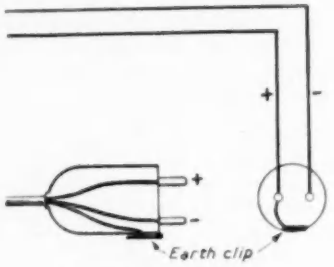
The burning was such as to leave a small air space between the live conductor and the end of the screw, so that when cold there was no contact, and a good insulation test was obtained. With current flowing the conductor warmed up and expanded, causing contact, and earthing. As soon as the fuse blew the conductor cooled off and the earth fault, of course, vanished rendering detection a most difficult and fortuitous matter.—*Haron.*

The Live Earth

RECENTLY I was called upon to inspect an iron that was giving a shock at times. I plugged it in to the customer's kitchen point (the kitchen has stone floor), and touched the

iron with my Testoscope and got a light. I took the iron away with me and took it down, but found nothing wrong, and when tested in my workshop, it gave no shock.

I then brought it back to my customer and, when I plugged it in, I touched it with the Testoscope and got a light. I knew there was nothing wrong with the iron and so inspected the socket. I found that the positive wire was connected to the earth clip as well as being



Incorrect plug connection

connected to the live side of the socket. I disconnected the positive wire from the earth clip and earthed the socket properly, and this was the end of the trouble.

The reason that a shock was only received at times was because there was only an earth clip on one side of the plug and socket, and if the earth clip on plug was not making contact with the one on socket (which was alive) by being pushed in upside down no shock was received. My customer told me that she has being using this for about twenty years without ever getting a bad shock, and would not have bothered now but some neighbour advised her to.—*J. Fagan.*

Incorrect Testing

A CONSUMER rang up to say that his motor would not start, and inspection of the motor made it obvious that the machine was on two phases, as it occasionally did rotate very slowly when unloaded.

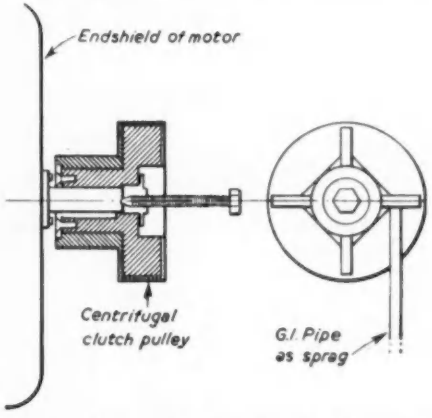
A test of the stator windings showed that the winding resistances matched up whilst a megger test confirmed that the insulation resistance was in order. A test with a neon tester showed apparently full voltage on the motor terminals and a voltmeter confirmed this, showing 400 V between lines and 230 V to earth.

An ammeter was then inserted in each of the supply lines and showed that the current in one line was appreciably less than that in the other two and a resistance test between the supply terminals and the motor terminals revealed a fairly high resistance in that line.

By a process of elimination this resistance was traced to a bad contact in the motor isolator. This was acting as a high resistance in the supply line and was sufficient to stop the motor working. Its value was, however, negligible in comparison with the resistance of the neon tester and the voltmeter and did not, therefore, affect their readings.—*J. P.*

Pulley Extractor

A THIRTY-FIVE h.p. s.c. group drive motor in our machine shop was fitted with a centrifugal clutch pulley to overcome poor starting torque. When overhauling the motor at a later date it became necessary to remove the clutch pulley, and this was accomplished by the following method. A cap similar to the one fitted in the centre of the clutch was turned up and tapped to take a 1 in. × 15 in. fully threaded bolt. After removing the cover plate, shoes and other attachments, this cap was screwed into position



Details of the centrifugal clutch pulley fixing and the method adopted for removal

and the bolt tightened up gradually until the clutch pulley came off the shaft. To prevent the shaft rotating during this operation, a short length of g.i. pipe was used as a sprag against one of the vanes of the clutch sleeve.—*W. H. Gatehouse.*

Contributions to this page dealing with specific problems and items of interest to practical engineers are welcome and if used will be paid for at our standard rates. They should be written on one side of the paper only.

The Giorgi System of Units

Merits of the Rationalised and Unrationalised M.K.S. units are discussed at the I.E.E.

EVERY student of electrical engineering becomes, at an early stage of his technical education, acutely aware of the difference between the "absolute" values of electrical quantities and their "practical" values. Simultaneously the irruption of π into various formulae for no very apparent reason causes a certain amount of mental confusion. An attempt to eliminate these difficulties was made as long ago as 1901 by Prof. Giorgi with the introduction of the rationalised M.K.S. system of units. Since that date, although general approval has been given by the International Electrotechnical Committee to the M.K.S. system, considerable disagreement has been present as to whether the "rationalised" or "unrationalised" system should be used. A symposium of papers, presented to the I.E.E. last week, stated the case both for and against the two systems, although universal agreement with the M.K.S. system as a whole was evidenced.

To provide an understanding of the fundamental background of the problem, Mr. L. H. A. Carr[1] presented a general survey of the problem. He pointed out that the principle of the M.K.S. (Metre-Kilogramme-Second) system was that the electrical units should be identical with the practical units such as the volt, ampere, ohm, coulomb, farad, henry, watt and joule.

Apart from the three dimensions of length, mass and time, one further constant was necessary; this was "permeability of free space," μ_0, and by definition was equal to 10^{-7} in the unrationalised and $4\pi \times 10^{-7}$ in the rationalised systems. This factor was really a constant and provided a connecting link between the force F and current I. The paper showed the application of the M.K.S. system to various formulae.

Rationalisation

The question of rationalisation involved the moving of the constant, 4π, from one part of the fundamental equations to another. Thus its disappearance from some formulae would lead to its reappearance in others. The main reasons put forward for using the unrationalised system were that present calculations would be valid except for the position of the decimal point, and that all existing formulae would remain unchanged. Against that, Prof. G. H. Rawcliffe[2] argued that the rationalised system introduced anomalies in that π would appear in formulae in which circular functions were absent. He considered that the evils of an unrationalised system would multiply with progress and despite the temporary mental dislocation and confusion caused, he had no doubt of the ultimate wisdom of using the M.K.S. rationalised theory. The same viewpoint was expressed by Messrs. H. Marriott and A. L. Cullen[3], who also pointed out the virtues of having direct analogy between mechanical and electrical formulae. They did not believe that the alteration of basic formulae would lead to much trouble.

Education

Dr. Eric Bradshaw[4], in the last paper, discussed the problem of teaching the rationalised M.K.S. system, which he thought was best suited to the needs of electrical engineering science. He believed that students would benefit from a more practical or "engineering" approach in which particular concepts and their M.K.S. units were introduced as required, leaving the more abstract discussions to a later stage, and he gave a general outline of a suggested teaching development in the basic relations of electrotechnology.

1. THE M.K.S. OR GIORGI SYSTEM OF UNITS: L. H. A. Carr.
2. THE RATIONALISATION OF ELECTRICAL UNITS AND ITS EFFECT ON THE M.K.S. SYSTEM: Prof. G. H. Rawcliffe.
3. THE RATIONALISATION OF ELECTRICAL THEORY AND UNITS: H. Marriott and A. L. Cullen.
4. RATIONALISED M.K.S. UNITS IN ELECTRICAL ENGINEERING EDUCATION: Eric Bradshaw.

DISCUSSION

PROF. E. W. MARCHANT said that a simple system of units might save teachers and researchers much time and energy. The great advantage of the M.K.S. system was that the practical units—the ampere, volt, farad, henry—were the absolute units. A further advantage was the distinction between flux density B and magnetising force H, which some people found it difficult to understand. Lastly, there were only two quantities to remember μ_0, or free space permeability, and k_0, or absolute permittivity of medium.

PROF. R. O. KAPP said the proposed change of system should not be very upsetting, particularly as the practical units were not affected. Those chiefly affected by the change would be teachers and writers of textbooks. A great advantage of the system was ease of psychological approach, and the choice between the rationalised and the unrationalised M.K.S. system really depended on whether one was thinking in terms of fields or in terms of force between charges. His own choice would be for the rationalised system.

DR. L. HARTSHORN was in favour of the M.K.S. system, though it was asking a good deal of electrical engineers to expect them to change the habits of a lifetime. The other systems should be allowed to fade away and he was not in favour of tolerating them—as some people had suggested—side by side with the new system. The last thing one desired was to burden electrical science, and students in particular, with yet another system of units. The chief advantages of the M.K.S. system were simplicity, ease of remembering, familiarity of the units, familiarity of approach and practical convenience.

PROF. M. G. SAY said he had been teaching the M.K.S. system for some years and students found it attractive. He had heard no arguments against its adoption for engineering use. One difficulty that might confront students, however, was that reactionary examiners persisted in using C.G.S., whereas students had been taught in other systems. The difficulty was aggravated by the lack of suitable textbooks in this country as compared with America.

DR. H. PELZER, speaking on behalf of himself and Dr. Whitehead, said the main merit of the system was that it contained four fundamental units in place of three, which made the absolute system equivalent to the existing series of international practical electrical units. Many textbooks were written in other systems, however, and some help should be given to those who had to use more than one system. He outlined how this help could be given.

MR. R. J. HALSEY said he hoped the C.G.S. system would rapidly fade out, as the early M.G.S. system had done, leaving the M.K.S. system alone. It was extremely logical and was suitable to electrical engineering. He favoured the rationalised form himself. There were one or two awkward points in the system, and he did not know how teachers would get on when they had to define the unit of force. Some adjustment of ideas would be essential. However, he did not see how the practical engineer could resist its appeal.

MR. G. F. FREEMAN thought no one could fail to be struck by the general attitude of approval for the M.K.S. system. In his own experience very few examiners made use of it, and it might be well for the Institution to give some sort of directive both to examiners and to those who compiled examination syllabuses. While simplification was desirable, however, the short-term effect would be difficult, particularly for National Certificate students. The choice between rationalised and unrationalised units would depend in the main upon the particular field in which the person concerned was working, and here there might be practical difficulties.

PROF. EMRYS WILLIAMS said he was on the side of the rationalised M.K.S. system but even if the student knew all that was said about rationalisation in the four papers he could still find himself in difficulties because of the distinction between what he might call complete equations valid for all units and incomplete units valid only for particular units.

PROF. G. F. NICHOLSON said he agreed with the convincing arguments that had been put forward in favour of the inevitability of the rationalised M.K.S. system. The main beauty of the system was psychological and educational. In introducing the system one must consider the man tackling the subject for the first time, and the psychologically easy method of approach was *via* the mechanical concepts with which he was familiar and a new quantity, the electric charge. For the sake of posterity, he hoped the Institution would come down unequivocally in favour of the rationalised M.K.S. system of units.

MR. W. GRANT, speaking as an industrial engineer, said he was a convert to the M.K.S. system, but he thought the unrationalised system should be called the polar system and the rationalised system the plane system for easy recognition.

MR. C. T. BALDWIN confessed to some doubt as to the method of introducing the M.K.S. system. The suggestion that the approach should be gradual did not appeal to him. It would be more satisfactory, he thought, if teachers, at any rate, continued with the present system and gave students a thorough grounding in the present system of units. If this were done properly and the M.K.S. system were eventually adopted, there should be no difficulty in changing over. Any move towards a change should be taken slowly until such times as a complete change-over could be made. Electrical theory was affected by both the change to M.K.S. and the change from unrationalised to rationalised, and there should be only one upheaval and not two.

MR. A. DRAPER thought teachers of electrical science would be grateful to the Authors. Personally, he agreed that the adoption of the M.K.S. system should raise no difficulty in teaching—rather the reverse. At the college with which he was associated the change had been made three years ago and practical experience in the classroom had shown that this step was well justified.

His only regret was that they had started with the unrationalised instead of the rationalised system. Admittedly the change-over to the M.K.S. system was not easy and involved considerable recasting of lecture notes and remoulding of numerical examples, but the results repaid the effort. The few fundamental equations required were sufficient to take students a long way.

The Authors briefly replied to the discussion.

Links with the Consumer

Housecraft Advisers at the E.D.A. - E.A.W. Conference

Delegates listening to the opening address

OPENING the fifth post-war conference of Housecraft Advisers, Senior Demonstrators and Senior Showroom Assistants on Tuesday last week, Sir Henry Self pointed out the opportunities which the delegates had to train the next generation to realise the possibilities and potentialities of electricity.

As prophets, however, they must expect to be stoned—theirs was no easy task. There had never, he said, been any great movement in history which had succeeded without 20 years of hardships. Recommending the delegates to read closely the B.E.A. Report, and study the commercial policy laid down, he pointed out that the task of the housecraft adviser was to encourage the wise use of electricity, and help to fill in the valleys in the peak load curves.

More than 300 delegates from all parts of the country attended this conference to take part in a programme which, as is usual, maintained a nice balance between instruction and discussion, thus providing every delegate with a chance to learn, and to draw on the store of her own experience to assist others. "Respect for the English Language" was the subject of an amusing talk given by Mr. Lionel Hale, which followed Sir Henry Self's introductory speech. In the afternoon, delegates were free to visit the *Daily Mail* "Ideal Home" Exhibition.

A Cooker Review

The technical aspect of the housecraft adviser's task commenced on Wednesday, with a paper by Mr. J. I. Bernard, M.I.E.E., of E.D.A., on "The Post-War Cooker," in which he reviewed the changes which the last few years had wrought in design and performance.

Chief design improvements were in performance (automatic oven control and improved simmering control), easier cleaning (fewer projections and dirt traps, more pleasing appearance, lower maintenance and more reliable earthing arrangements.

Practically all post-war cookers had standardised dimensions of 36 in. high by 21 in. by 21 in., in accordance with BS1195 (Kitchen Fitments). Designers who had used steel pressings almost exclusively were now tending towards the retention of iron castings for important structural members, such as front frame, door frame and hob. Vitreous enamel was employed throughout.

Oven design favoured larger cooking space (2,250-2,750 cu in.) and side and bottom heating was almost universal, this being frequently provided by single tubular elements on each side, bent so that part of the element was beneath the oven floor. War time developments had made great improvements in oven elements, which were practically everlasting. Removable oven linings were frequently used, either in one piece or in sections, and some models were available with drop-down doors.

Oven loadings were higher (2-2½ kW) and some designers reduced thermal capacity of insulation by the use of aluminium foil and glass silk. Bi-metal and hydraulic thermostats were both used, some having two-stage operation. Thermostat markings were now standardised.

Eight inch and 6 in. boiling plates had been standardised, using E.D.A. interchangeability methods. Solid pattern plates were more usually supplied, but radiant pattern plates were available at an extra cost. Close regulation of simmering heat was catered for by a variety of methods using multi-position switches or simmerstats.

The standardisation of the 10½ in. by 8 in. grill-boiler in place of separate grills, and the restricted area of the hob had resulted in 3-plate cookers being designed with the grill-boiler "cross-wise" in the hob, and to facilitate

manufacture, this was retained for 2-plate cookers.

Cam-operated multi-way switches and glass fibre insulation for internal connections were two further developments which were to be found.

Export and Baby Cookers

Export model cookers had recently become available for the home market, employing top and bottom oven heating without separate grill or under-hob space, and provided with three or four hot plates. They had been designed for countries where Continental or American cookers were used, and it remained to be seen whether they would prove popular in this country.

Table cookers had now "grown up" by the addition of separate boiling plates and larger ovens.

Commercial Cooking Equipment

Although there had not been so much change in the design of heavy-duty equipment, ranges had been reduced in height, the external appearance had been improved and thermostats on ovens and simmerstats on boiling plates were in increasing use. Roasting-baking ovens, steaming ovens and hot cupboards had all been improved in design and there was an increased variety of counter equipment available.

Washing Machines

Capabilities—and limitations—of the domestic washing machine was the theme of a paper by Miss Joan Whitgift (Simplex Electric Co., Ltd.). A washing machine could be expected to wash, to be easy and safe to operate, and to wash without harm to the fabric. If it did those things, it was a washing machine. If it got clothes really clean without manual scrubbing, presented a simple solution to the rinsing problem and wrung out some of the water, it had already stepped beyond the bounds of being a mere washing machine.

There were, however, other tasks connected with wash day, such as boiling, starching, rinsing, drying, damping and ironing, folding, airing, and providing sufficient hot water. The housewife had come to believe that the possession of a washing machine would solve all these problems. It was up to the housecraft adviser to persuade her that she could not expect impossibilities. Some of the answers to be borne in mind when selling washing machines were then quoted.

1. All fabrics depreciate with washing—however they are washed.

2. Woollens such as blankets, woollen fabrics, or hand-knitted goods must be washed with as little movement as possible.

3. Clothes should not be mixed. Wool and cotton or "whites" and "colours" should not go in the same tub.

4. The tub must not be overloaded, and some are a nuisance with splashing if they are underloaded.

5. Few washing machines allow for the actual boiling of clothes but the necessity for boiling does not exist if they are given a little bleach and are ironed.

6. Plenty of hot water is required, but with a washing machine and detergents not as much as would be needed if one were washing by hand. The trouble is, of course, that numbers of people now do the wash who would never have dreamed of undertaking it by hand. Some machines incorporate a heating element in them. Alternatively, one can install a water heater.

7. The washing machine is much less extravagant of soap. It will also function admirably with detergents.

Once a customer clearly understood these points, she was in a much better frame of mind, and far less liable to be disappointed later. The washing machine should be regarded as a unit in the home laundry. Drying cabinets, ironers and water heaters were other necessities.

Communal Laundries

Mrs. E. A. Windsor (Northern Sub-Area, L.E.B.) read a paper on the use of washing machines in communal laundries, which she defined as laundries attached to housing estates, as distinct from public wash houses and "laundrettes," where attendants controlled the machines.

A particular installation at Hackney was then described in some detail, special stress being laid on the points which the housecraft adviser should bear in mind when recommending machines for this type of service. The fact that they would be operated by other than skilled attendants, the long hours of use as compared with normal domestic usage, and the tendency for machines to be neglected and misused were all important points.

The regular attendance of a demonstrator for some time after installation, ensuring that users were familiar with the correct methods of operation, was highly desirable, not only to ensure that the users were satisfied, but that the owners of the building were getting a fair deal in the prevention of misuse of machines and

waste of power (including the uneconomic use of hot water).

Details of cost and consumption were given and suggestions for extending the use of the washing machine in small laundries in hostels, hairdressers, hospitals and other locations. The associated water heating load, particularly if overnight heating were used, was another important factor to be borne in mind.

Other Papers

The "Art of Public Speaking" was a contribution made by Mrs. Frank Forrest.

Two other papers were presented by holders of Caroline Haslett Travelling Exhibitions. Miss Elizabeth Gwillim, the 1949 holder, spoke on "Some Aspects of the Electrification of Holland," while Miss Marjorie Gordon, M.A., B.SC., the first holder of the Teachers Exhibition, spoke on "Teaching Electricity in American Girls' Schools." Both these papers have already been reviewed in these pages (ELECTRICAL TIMES, December 22, 1949, p. 822, and January 26, 1950, p. 143).

A session was also devoted to Visual Aids, in which a number of films were shown and Mr. J. A. Stedman, M.A., of E.D.A., gave a talk on visual aids to electrical education, with suggestions for their use.

The conference terminated with an informal lunch at the Connaught Rooms and "At Home" at the headquarters of the Electrical Association for Women.

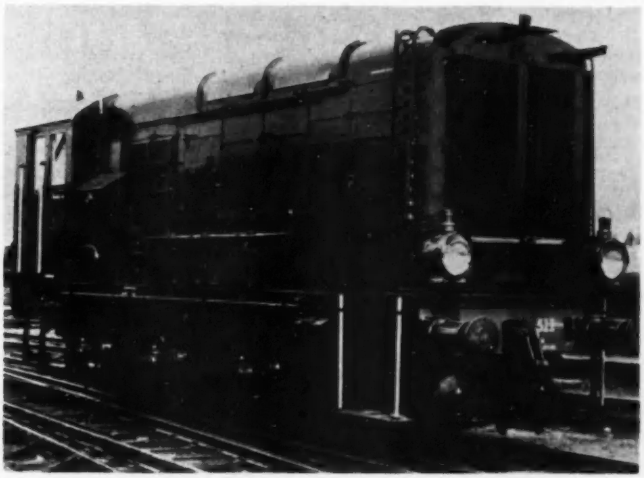
Diesel-Electrics for the Netherlands

FOLLOWING their experience in the operation of English Electric 350 b.h.p. diesel-electric locomotives supplied to them by the Ministry of Supply, the Netherlands Railways placed an order with the Company in 1949 for ten complete locomotives of a type generally similar, but using, in this case, a 6 KT diesel engine developing 400 b.h.p.

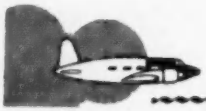
The diesel engine and electrical equipment generally conform with the standard designs utilised by the English Electric Co. for the 250 diesel electric shunting locomotives they have supplied to railway systems in Great Britain and abroad. The power is transmitted from the main generator, which is direct coupled to the diesel engine, to two nose-suspended traction motors driving through double reduction gears. The control equipment is housed in a desk-type control cubicle in the driver's cab, arranged to permit operation from either side of the locomotive. A nickel-alkaline battery is provided, as on the previous locomotives from the Ministry of Supply, its main function being to provide current for motoring the main generator for starting purposes.

The first of these locomotives was completed and delivered in July, 1949, and has since been in service in the Feyenoord marshalling yard at Rotterdam. The remaining nine locomotives will be delivered in 1950.

A novel method of transportation to Holland was adopted, as the locomotive was shipped on the train ferry from Harwich to Zeebrugge, having been hauled "dead" from the English Electric works at Preston.



English Electric diesel-electric locomotive supplied to the Netherlands



overseas news

Railways in Russia

More than 50 miles of newly electrified railway lines will be put into operation in the Moscow suburbs this year. In the next few years all suburban railway traffic of a number of big railway centres, such as Moscow, Kiev and Sverdlovsk, will be electrified, it is stated. Russia at present has 1,875 miles of electrified line, and this year, in addition to the Moscow extensions, other lines are being electrified in the Urals, Siberia and the Donetz Basin.

Tennyson Tender

At a special meeting of the Brisbane Council Stores Board last month, it was decided to recommend that the work of building the foundations for the new Tennyson power house should be offered to M. R. Hornibrook Pty Ltd., on a cost-plus basis. This firm had submitted a tender of £360,000, which was higher than had been expected.

Clarence River Project

Construction of the Clarence River hydro-electric and irrigation scheme may commence within the next twelve months, Mr. Casey, the Minister for Supply and Development, stated last month. He indicated that if the special committee of the New South Wales and Queensland Governments recommended the scheme, the Commonwealth Government would almost certainly agree to help finance the project. The scheme, which calls for the damming of the Clarence River at The Gorge, 35 miles from Grafton, and subsidiary dams on ten of its tributaries, together with the construction of power stations at these points, is estimated to cost between £10 and £12 million.

Control of Contractors in B.C.

The regulations governing certificates of competency for electrical contractors in British Columbia, to which we referred in our March 16 issue, become effective on April 17 next. Under the new regulations prospective electrical contractors will have to pass theoretical and practical examinations before receiving a certificate of competency. It will be unlawful for any person to carry on business as an electrical contractor unless he is the holder of a certificate. Explaining the regulations at a joint meeting of the Victoria B.C. Electrical Association and the Electrical Service League of B.C., Mr. L. Robson, chief inspector of electrical energy, Vancouver, said they were intended to protect the public against incompetent contractors. He said Quebec and Saskatchewan were the only two provinces in Canada to have similar regulations. In Saskatchewan the regulations included electrical dealers in order to protect the public against sale of electrical equipment which did not come up to standard requirements. Mr. Robson said three types of certificates would be issued—certificate "A" permitting the holder to do any type of electrical work; certificate "B" restricting the holder to undertake electrical installations not exceeding 750 V; and certificate "C" which permitted only installations up to 300 V. To date his Department had received 425 applications for certificates—many for class "A."

B. C. Acquisition

The British Columbia Power Commission has been authorised to purchase from the city of Merritt the diesel electric generating plant and distribution system. The Commission is to install new generating units and to rebuild the existing distribution system at an approximate cost of $225,000.

Toronto and O.H. Lines

In reversal of its own policy to ban the erection of overhead wires in the streets of Toronto, the City Council last month agreed to allow the Hydro-Electric Power Commission of Ontario to erect three steel towers to carry power lines from the new waterfront steam generating station. The Commissioners proposed to run the lines o.h. across Commissioners and Keating Streets, and then underground to Strachan Avenue. It was said that to place the lines underground would add $1,000,000 to the cost. One member remarked that although the area was industrial, the towers would add to the chaos and disfigurement of the scene greeting Toronto visitors from the east. The Mayor pointed out that to insist on the mains being placed underground, thereby increasing costs, may have an effect on future charges.

A Canadian Plant for Britain ?

Two officials of Beatty Bros., of Toronto, are shortly to visit England to consider the possibility of establishing a branch plant near Manchester, for the manufacture of the company's electrical appliances. The Canadian company has just started the production of a new automatic washing machine.

Swiss Schemes

The Cantonal authorities at Basle, Switzerland, have under consideration a scheme for the erection of a power station at Birsfelden, on the Rhine, which, it is considered would generate 362 million units per annum, with normal water supplies. Estimated cost of the project is 136 million francs.

A second thermal power plant construction by the North-East Electricity Co., at Weinfelden, on the River Thur, with a capacity of 20,000 kW. Costs are estimated at 20 million francs, including cables and storage tanks for 5,000 cu.m. of oil.

Electric Locos for Spain

The Spanish National Railways have placed an order with the English Electric Export and Trading Co., for 3,600 h.p., 3,000 V, d.c., 5 ft 6 in. gauge, main line electric locomotives to the total value of £2,713,400. The first phase of this contract provides for 20 locomotives to be built at the Preston works of the English Electric Co., in conjunction with Vulcan Foundry, Ltd., as sub-contractors. It is expected that the first of these locomotives will be delivered in Spain within 18 months. This order for electric locos, is part of the plan of the Government of Spain to increase the capacity of the railroads, and thereby build up the country's industrial economy.

Madras Nationalisation

Mr. M. Bhaktavatsalam, Minister for Public Works, with the Government of Madras, took over the North Arcot Electric Supply Corporation as a first step in the nationalisation of electricity from Mr. C. S. Srinivasa Mudaliar, ex-officio Director of the Corporation, a few days ago. The Minister handed over to Mr. Mudaliar, on behalf of the Government, a cheque for Rs. 3½ lakhs, the balance to be paid later after ascertaining the total. The Minister announced that the Electric Power Supply Corporation at Vellore and that at Ambur-Vaniambadi would shortly be taken over by the Government. A little earlier he had told the Legislative Assembly that the Government would complete nationalisation of electricity undertakings in the State in about five years. A total of 39 undertakings are to be acquired in five batches, the less efficient ones being taken over first.

Judgment for Cawnpore E.S.C.

Judgment was given in the Allahabad High Court last Thursday in favour of the Cawnpore Electric Supply Corpn., Ltd., in its action against the United Provinces Government and two former employees of the company, representing the Cawnpore Electric Supply Workers' Union. The company was granted a decree with costs to the plaintiff company, their Lordships declaring that the order of the Government enforcing the award of the conciliator was illegal and void, and perpetually restraining the Government from enforcing the award. The suit was also decreed against the union and all other former employees of the plaintiff company perpetually restraining them from enforcing the Government's order or the conciliator's award. (At the earlier hearing, reported in our March 2 issue, it was stated that the conciliator had proposed the distribution to employees of 50% of the reserve fund, and a bonus).

Distribution—Underground or O.H.

Faced with public expressions of a desire to see overhead distribution wires removed in favour of underground cabling, the Christchurch (N.Z.) Electricity Committee is now getting down to the concrete side of the proposal. At a meeting last month, Mr. L. G. Amos, chairman of the committee, said he considered the City Council had, by its opinion that a start should be made with underground power distribution, given a mandate for the committee to propose suitable experimental areas as opportunities occurred. He suggested that the most economical place to start was probably in the central area where big improvements could be made and a large number of consumers served. When a new area was subdivided, opportunities for experiment occurred, but there might then be complaints about the whole undertaking paying for the priviledge of a few. Mr. J. C. Forsyth, engineer-manager of the Municipal Electricity Department, stated in a report that there was no case, on economic grounds, for the replacement of any portion of the existing overhead distribution system with an underground system, or for the installation of an underground system in a new area. From operating conditions, an o.h. system was preferable, as faults could be more quickly located and repaired. He agreed that the case was more attractive for the central area, but even there, it was out of the question on economic grounds with the present high prices of metals. One member suggested that an excellent chance of introducing the underground system occurred in new housing blocks, where some Government financial assistance might be obtained. The director of parks and reserves reported that Christchurch must either discontinue planting trees in the streets or put wires underground. Another member suggested that in the central area, interference with the streets could be avoided and accessibility to cables obtained by running carrier tubing along the verandahs. The chairman of the town-planning committee, said more information was required about the ultimate cost to the consumer, and he urged that this aspect of the matter should be further considered.

Atom Power in U.S.A.

Present indications were that it would be from ten to fifteen years before there was any commercial generation of nuclear power, Mr. Philip Sporn, president of the American Gas and Electricity Co., stated in the company's annual report. Last summer, the Atomic Energy Commission appointed a three-man special advisory committee on co-operation with the electric power industry and designated Mr. Sporn as chairman of the group. Based on the studies, Mr. Sporn said commercial generation of nuclear power was still some ten to fifteen years away, "even in the limited sense of more or less regular operation of a generating plant in conjunction with research, and without regard to the costs involved."

PERSONALITIES

IN THE INDUSTRY

Following the appointment of Mr. A. R. C. White as district manager, West Cornwall, **Mr. L. F. Weir,** B.SC.(ENG.), has been nominated as sub-area engineer, Cornwall sub-area, South-Western Electricity Board. A native of Portsmouth, Mr. Weir served an apprenticeship with the English Electric Co. Subsequently he held various engineering and commercial posts with the Cornwall Electric Power Co. and the Isle of Wight Electric Light and Power Co. Last year he became the Board's deputy sub-area engineer, Cornwall sub-area.

Mr. L. F. Weir

Previously a generation construction engineer in the North-Western Division of the B.E.A., **Mr. E. S. Booth,** M.ENG., A.M.I.E.E., A.M.I.MECH.E., has been appointed engineer in charge of the co-ordination section of that Division's generation construction Department at headquarters. Mr. Booth will be remembered as chief engineer and manager of the Salford undertaking prior to vesting day, a position to which he succeeded in May, 1947, on the retirement of Mr. L. Romero. Educated at Liverpool University, he served an apprenticeship with Metropolitan-Vickers, subsequently joining the Yorkshire Electric Power Co. as a member of the power station and substation staff. He became deputy city electrical engineer at Salford in August, 1946. Mr. Booth has been intimately connected with the new stations now under construction in the Division, notably Agecroft, Westwood, Huncoat, Chadderton, and Trafford stations.

Mr. E. S. Booth

Mr. H. Firminger, M.I.R.S.E., and **Mr. W. H. Challis** have been appointed principal executive assistants in the office of the Signal Engineer of London Transport.

At the recent annual meeting of the Liverpool Engineering Society, **Mr. J. Eccles,** M.M., B.SC., M.I.E.E., M.INST.C.E., M.I.MECH.E., chairman of the Merseyside and North Wales Electricity Board, was elected president for the ensuing year.

Cable and Wireless Ltd. announce that **Mr. J. Innes,** C.B., managing director, retired from that post on March 31, and **Maj.-Gen. L. B. Nicholls,** C.B., C.B.E., M.I.E.E., has been appointed to succeed him.

Mr. W. E. B. Nettleton, A.M.I.E.E., who has been elected president of the Sheffield Electrical Trade Technical Society, as we noted last week, is of course, engineer of the Yorkshire Board's No. 3 sub-area and not manager as stated. **Mr. A. Haddock,** B.SC., M.I.E.E., holds the latter position.

The Electroplant Co. announces that **Mr. E. A. Warburton Whitehead** has ceased to act as sales manager of the company as and from 31st March, 1950, and is no longer in the firm's employ.

Mr. P. Tonks and **Mr. F. W. Morris** have been elected additional directors of Revo Electric Co., Ltd.

At the recent meeting of the Industrial Association of Wales and Monmouthshire, **Lt.-Col. J. Rankin,** O.B.E., F.C.I.S., COMP.I.E.E., M.INST.F., was elected president for the ensuing year. He is, of course, secretary of the Merseyside and North Wales Electricity Board.

District engineer in the Merthyr district of the South Wales Electricity Board, **Mr. G. Clark,** A.M.I.E.E., has relinquished that position to take up an appointment with a firm of consulting engineers in Calcutta. Earlier, he was engineer and manager to the former Merthyr Electric Traction and Lighting Co. A dinner was held in Merthyr recently by the staff and employees of that undertaking, to bid farewell to Mr. Clark and wish him all success in his future career.

Mr. Clark, right, receives good wishes from Mr. A. B. Cousins

Last Friday, **Mr. Sydney H. Brewell,** M.B.E., chairman and managing director of A. H. Hunt Ltd., sailed in *R.M.S. Queen Mary* for America. His visit is in connection with existing licence arrangements for the manufacture of metallised paper capacitors in the U.S.A. and Canada, under Hunts' patents.

In the reorganisation of the sub-area set-up of the South-Western Electricity Board, details of which are given on page 571, **Mr. L. V. Turner,** M.I.E.E., continues as manager of the new Taunton sub-area, with offices in that town, and **Mr. G. T. Garwood,** M.Sc.(Eng.), M.Inst.C.E., M.I.E.E., is manager of the new Devon sub-area, remaining at his present sub-area office in Exeter. **Mr. G. J. Hollyer,** M.I.E.E., who has been the Board's sub-area manager at Torquay, is to retire at the end of June after completing 44 years' service in the electricity supply industry.

Mr. Barrie Heath has been appointed to the Board of Powell Duffryn Carbon Products, Ltd., as managing director. In addition, **Dr. D. B. Foster,** who has been associated with the development of the Company's various grades of carbon at the Powell Duffryn Research Laboratories, has also joined the Board of the Company.

We are sorry to hear that **Mr. K. W. Finch,** B.Sc., A.M.I.E.E., A.C.I.S., Cheltenham district manager of the Midlands Electricity Board, recently entered Cheltenham General Hospital for a minor operation. We trust he will make an early and complete recovery.

The Council of the City and Guilds of London Institute has conferred the distinction of Fellowship of the Institute (F.C.G.I.) on: **Mr. H. Grinsted,** C.B.E., A.C.G.I., B.Sc.(Eng), F.R.Ae.S., **Mr. W. H. Grinsted,** M.B.E., A.C.G.I., M.I.E.E., **Mr. G. Lacey,** C.I.E., A.C.G.I., B.Sc.(Eng.), M.I.C.E., M.I.W.E., F.R.S.A., and **Sir Kenneth Grant Mitchell,** K.C.I.E., A.C.G.I., M.I.C.E., M.Inst.T., M.I.E.(Ind.).

At the annual general meeting of the Batti-Wallahs' Society, held last week, **Mr. H. Nimmo,** M.I.E.E., M.Inst.C.E., M.I.Mech.E., chairman of the Southern Electricity Board, was elected president for the ensuing year in succession to **Mr. Forbes Jackson,** M.I.E.E., who held office from March, 1949. **Mr. A. H. Hughes** was re-elected honorary secretary and treasurer with **Mr. J. Temple Hazell** again as assistant honorary secretary and treasurer. Elected members of the Committee were Messrs. M. D. Cloran, A. G. Freeborn, J. W. Perkins, A. N. East, J. W. Porter, and J. Nelson, with Mr. J. W. Woolley as co-opted member.

Mr. H. Nimmo

At the recent annual meeting of the Electric Light Fittings Association, **Mr. K. Scott Adie,** of Rowlands Electrical Accessories, Ltd., was elected president of the Association for the ensuing year.

Mr. K. Scott Adie

The British Electricity Authority has appointed **Mr. F. W. Smith,** C.M.G., M.C., to be a chief officer of the Authority. Mr. Smith, who has been released from his appointment as a deputy secretary by the Ministry of Fuel and Power, will have responsibility for contract negotiations and procedure arising out of the capital plant programme. In performing his duties, he will act in close association with the chief engineer, Mr. V A. Pask.

Formerly station superintendent at Prince of Wales power station, Rotherham, Yorkshire Division, **Mr. R. S. Atkinson,** A.M.I.E.E., A.M.I.Mech.E., has now taken up duties as generation engineer, operation, with the South-Eastern Division. At Rotherham, Mr. Atkinson has been succeeded by **Mr. J. W. R. Woolmore,** who was previously station superintendent at Mexborough. In addition, **Mr. P. E. Austin,** B.Sc. (Eng.), A.M.I.E.E., formerly superintendent at Barugh, has assumed the post of station superintendent at Mexborough vacated by Mr. Woolmore.

Mr. R. S. Atkinson

OBITUARY

The death occurred on March 19, of **Mr. T. D. Sutcliffe,** aged 35, joint managing director of Richard Sutcliffe, Ltd.

We note the death on March 24, of **Mr. R. E. Shawcross,** A.K.C., M.I.E.E., aged 76, who was for many years a lecturer in the Department of Electrical Engineering at King's College, London, from which position he resigned in December 1923.

We regret to note the death on 1 April, of **Mr. W. F. Campling,** O.B.E., A.M.I.I.A., aged 44, works manager and director of Thomas De La Rue and Co., Ltd., and director of Thomas De La Rue Institutions Ltd., who, prior to joining that firm in 1948, has been connected with the County of London Electric Supply Co., and associated concerns for 23 years, latterly as regional manager, south.

The death occurred on 30th March of **Mr. C. F. Johnston,** chairman of F. W. Elliott, Ltd., and late proprietor and managing director of Gillett and Johnson, Ltd.

NEW SALARY AGREEMENT

Scales for Showroom and Commercial Staff

THE long-awaited permanent salary agreement covering clerical, administrative and commercial staff of the Electricity Boards and Generating Divisions of the B.E.A., has now been concluded by the National Joint Council (Administrative and Clerical Grades) as the result of discussions between representatives of N.A.L.G.O. and the Authority. It is intended that all posts within the scope of the Council should be graded in accordance with the scheme, as from April 1, 1950, but provision is made for any personal rights under existing contracts of service to be preserved. Thus, for the first time, national scales will now apply to administrative and clerical posts in the supply industry.

The Scale

The provincial salary scales are as follows:

Grade 1: £310 by £20—£390
Grade 2: £390 by £20—£450
Grade 3: £450 by £20—£510
Grade 4: £510 by £20—£570
Grade 5: £570 by £20—£630
Grade 6: £630 by £25—£705
Grade 7: £705 by £30—£795
Grade 8: £795 by £35—£900
Grade 9: £900 by £40—£1,020

For staff who are principally employed within the London Metropolitan Police Area, there is an increase of £15 to employees under 21, and an addition of 5%, subject to a minimum of £30 and a maximum of £40, for those over 21 years of age.

Under commercial staff grading, service centre demonstrators are listed as Grade 1, progress beyond £350 being subject to a certificate that the person concerned is capable of undertaking all the duties of the grade. Senior demonstrators and/or housecraft advisers, responsible for demonstrations and supervision of demonstrators, are classed under Grade 2. For senior service centre assistants, the grade is either 1 or 2 in a centre with a staff of 1 or 2, and 2 or 3 where the staff numbers 3 to 5, while in larger service centres the grade is 2.

Supervisors responsible for a service centre with a staff of 6 to 8 are in Grade 4, and in larger centres, 5; while sales representatives in showrooms are given Grade 1, and senior sales representatives, 2. Grades 6 to 9 are allocated to cover district commercial officers, and 3 to 6 for district senior commercial assistants. It is noted that specialist officers, where appointed, should be graded on the same basis as district senior commercial assistants. For district commercial assistants, the Grades 1 to 3 are allocated.

It is pointed out, however, that the allocation of commercial staff to the various negotiating bodies is still a matter for determination. For the time being, therefore, the term commercial staff used in this agreement can be taken to refer to staff other than those already covered by the N.J.B. agreement.

Sub. Area H.Q.

At sub-area headquarters, senior demonstrators and/or housecraft advisers responsible for recruitment and training of staff, co-operation with section heads at sub-areas, policy and planning, etc., come under Grades 3 to 6, while assistants with special responsibility are in Grade 3, and others in Grades 1 or 2. For senior assistants responsible for sub-sections such as administration, estates and wayleaves, insurance, consumer's accounts, costing and stores, general accountancy, salaries, etc., Grades 3 to 6 are applicable, and where the size of the sub-area and the responsibilities of a post warrant it, a position may be classified as principal assistant under Grades 5 to 9.

At Area Board headquarters, the grades covering principal assistants of the various sections are 5 to 9, for senior assistants in charge of sub-sections, 3 to 6, and for other assistants, 1 to 3. It should be emphasised here, that no differentiation has been made for women in the foregoing grades; the matter remains unprejudiced for determination in accordance with Government policy.

The agreement also sets out various grades for general clerical staff, including typists and accounting machine operators.

Divisional Staff

On the generating side of the industry, at divisional headquarters, senior assistants responsible for sub-sections are allocated Grades 3 to 6, and principal assistants are placed in Grades 5 to 9. Assistants with special responsibility are in Grade 3, and others in Grades 1 or 2. Station clerks in power stations with up to 100 employees, are given Grade 1 or 2, in those with from 101 to 250 employees, 2 or 3; from 251 to 500 employees, Grades 3 or 4, and in stations with over 500 employees, Grades 4 or 5 (where payroll and/or accounting is also dealt with, clerks in the last three categories are upgraded). Station assistants may be allocated to Grades 1 to 3, according to responsibilities.

At Divisional Group headquarters, senior assistants responsible for sub-sections, are graded 3 to 6, principal assistants under Grades 5 to 9, and other assistants Grades 1 to 3.

It will be seen that the scales provide a considerable degree of flexibility, made necessary by the variation in size, number of consumers and administrative organisation of the Area Boards. It is expected that there will be some disagreement in the application of the scheme, and in such cases the matter is to be discussed, in the first instance, by a representative of the Union and a Board official, and may be referred further. In any event, the application of the scheme is to be reviewed in a year's time.

The BUYER'S *Column*

—And Now the "Cadet"

A COOKER for cramped quarters, which is easy to install, easy to operate and fun to cook with—this is how SIMPLEX ELECTRIC CO. LTD., of Oldbury, Birmingham, describe their latest aid to good living, the Creda "Cadet."

Ample oven space characterises the "Cadet"

Dimensions of the new "baby" are pleasing—overall measurements are only 18¼ in. by 16¼ in. by 18 in., whilst the oven space is ample—enough to cook an excellent meal, as can be judged from our illustration.

Finished in cream vitreous enamel, the cooker has been carefully designed for its job. It's easy to clean; a wipe with a damp cloth will help retain its attractive finish indefinitely. The whole hob of the cooker lifts off or can be opened to 45° to give access to the drip tray under the boiling plate.

The three elements in the "Cadet" are: the 8 in. diameter radiant type boiling plate, controlled by "Simmerstat" and loaded at 1·7 kW; the top oven element (800 W) which is adapted for grilling by means of the movable oven racks; and the enclosed sheathed element at the bottom of the oven.

Total loading of the "Cadet" is 2·8 kW, making it convenient and safe for connection to 13/15-amp power points.

Most certainly these attractive features of the "Cadet" will make it a fast-selling proposition for retailers and service centres.

Light News from All Fronts

NEWS from ten lamp and lighting manufacturers reveals the release of three interesting lighting developments.

Silica dust sprayed onto the interiors of filament lamp bulbs affords even more diffusion of light from the coiled coil filaments, whilst still retaining a high efficiency. This new lamp has been placed on the market under various names, but in accordance with E.L.M.A. agreements the price of all makes is standard. These lamps are available for 200/260 V supply, are rated 100 W and cost 2s., plus purchase tax 7d. The names used by the various makers are "Argenta" by Philips Electrical, "Metropal" by Metrovick, "Opalised" by Stella Lamps, "Silverlight" used by B.T.H., "Mazda," G.E.C. "Osram," Ediswan and Popes, "Opalite" by Cryselco, "Silvalux" by Siemens and "Whitelight" by Crompton Parkinson.

Coloured fluorescent lamps have now been added to the range of lamps produced by the E.L.M.A. member firms. Crompton Parkinson describe the colours as pillar box red, buttercup yellow, Cambridge blue and emerald green. The lamps are also being supplied by B.T.H. "Mazda," "Ediswan," Siemens, "Metrovick," "Stella," G.E.C. "Osram" and Cryselco. Apart from the colour changes the lamps are similar to the standard 5 ft 80 W tubes. Price is 20s. plus 5s. 3d. purchase tax.

Third introduction is announced by all ten manufacturing companies. The recent "Mellow" 5 ft tubes are supplemented by 4 ft 40 W tubes retailing at 14s., plus 3s. 8d. purchase tax, or for instant-start circuits at 15s., plus 3s. 11d. purchase tax.

Marked Advance in Switch Design

A NEW range of a.c. only rotary flush switches which establish a marked advance in design and dependability, have been introduced by DIAMOND "H" SWITCHES LTD., Gunnersbury Avenue, London W.4.

Produced in two main patterns, they comprise the small 1 a.c. series, 1⅞ in. square by 1⅛ in. deep, primarily designed for electric cooker control, and the 2 a.c. multi-circuit series suitable for many other domestic and industrial appliances, 1⅞ in. square by 2¼ in. deep.

Both types were briefly mentioned in our issue of March 9, and we are now able to add further details and to reproduce illustrations showing some of the attractive features which this pioneer maker now offers.

All current-carrying parts are made from highest

quality material and contacts are of fine silver. The insulating base material has been carefully selected for stability under high ambient temperature and after extensive electrical and mechanical tests.

The operating spindle is the standard "Diamond H" push-on grub screw fixed type as used in the company's latest quick make-and-break rotary switches.

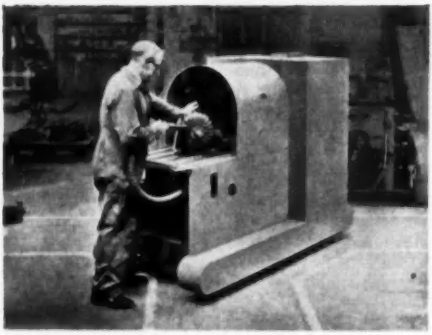
One hundred thousand cycle tests, carried out at 20% above rated capacity, and, to meet special requirements, at 50% above rated loads, left the switches in a condition which indicated a normal life many times that of the old quick make-and-break switch for d.c. supply, it is stated.

The switches are positive and silent in action, easy to operate and are substantially cheaper than the a.c./d.c. switch.

Dust Collection by the "Drymat"

OUR illustration shows a recent adaption of the "Drymat" unit dust collector, which is manufactured by DALLOW LAMBERT AND CO. LTD., Spalding Street, Leicester.

This new portable unit should help solve the dust control problems which confront maintenance engineers in many branches of industry. Usually the engineer resorts to the use of compressed air for blowing out accumulations of dust and grit. Whilst this removes the dust from one section of the machinery, it does so at the expense of other plant upon which the dust so removed then settles. The "Drymat" unit, however, incorporates a suction hood which takes care of the dust displaced by the blower.



The "Drymat" dust collector in action

For ease of operation the unit can be fitted with a turntable in place of the standard rigid table.

Getting off to a good start

SUCCESSFUL results in tests applied to the "Omega" Glow Starter switch for fluorescent lighting equipments have led the manufacturers OMEGA LAMPWORKS LTD. of Rodney Place, London, S.W.19, to introduce these switches as a regular stock line.

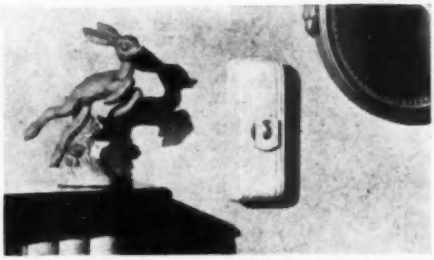
Normal striking time at 230 V is 1·5 to 2·5 seconds and every switch is tested to strike at 180 V. They can be used on 30, 40 or 80 W. installations with equal facility.

During tests one of these switches gave more than 10,000 starts and was still in good order.

Retail price of these switches is 4s. 3d. less trade discount. Special terms being available to fittings manufacturers.

Controlled Comfort

ECONOMY and comfort do not always run together, but with the introduction of the RT1 room thermostat made by H.M.V. HOUSEHOLD APPLIANCES (The Gramophone Co. Ltd.), Hayes, Middlesex, a new era of home comfort is reached.



H.M.V.'s room thermostat harmonises with its surroundings

Incorporated in the circuit between the power point and your electric heater, the room thermostat automatically maintains the living-room at a comfortable temperature and helps to cut your quarterly account. Mounted in an elegant cream casing, the thermostat affords exact temperature control by means of a centre calibrated dial knob giving Fahrenheit readings. The accessory is suitable for positioning on a wall or for fitting to a standard conduit junction box.

TRADE PUBLICATIONS

ALUMINIUM AND ALUMINIUM ALLOYS. A wall chart, published by the Aluminium Development Association, 33 Grosvenor Street, London, W.1, gives a cross reference between the new B.S. nomenclature for aluminium and aluminium alloys and the STA7, DTD and old BS specification. The approximate composition of the major constituents is also included.

MOLYBDENUM. Production, properties and applications of molybdenum, which has many uses in contact technique and lamp and valve manufacture, are discussed in an 8 page reprint available from Murex Ltd., Rainham, Essex.

CRANE PROTECTIVE PANELS. Features of the construction and design of the "Deren" range are illustrated in a leaflet issued by De Renzi Holmes & Co., Ltd., Fox's Lane, Wolverhampton.

Electricity in Baking

its application from a maintenance man's viewpoint

By W. H. ATKINSON

A BAKERY maintenance man removed a faulty 80 W fluorescent fitting for repair and left a 100 W tungsten lamp in its place.

Soon there were inquiries from the manager as the female staff in the area had threatened to stop work. The old kind of lamp was making the place too warm.

Although the wall thermometer did not agree, they were adamant, and professed complete satisfaction when the fitting was returned.

The blue content of the tube, so chilling in other situations, had the effect of suggesting a cooler atmosphere than was actually the case.

Double-deck 8'x4' Peel-type bread baking oven at Zetland's Ltd. Brighton, with a loading of 18 kW per deck

In the modern design of baking establishments, electricity plays a vital part. The electric motor has completely superseded all other drives, and the sturdy squirrel-cage unit is highly popular.

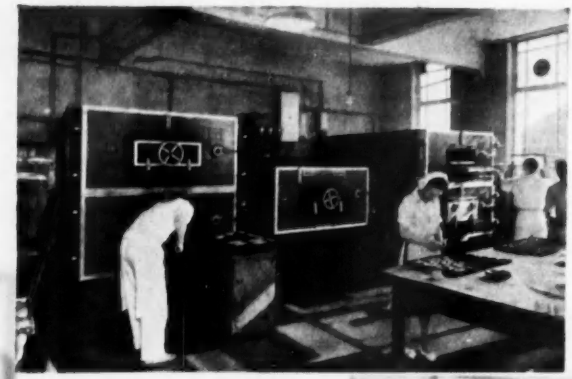
Variable Speed Drives

There are certain applications, however, where speed variation is essential or desirable. Here, the variable speed motor has certain distinct advantages over the combination of fixed speed motor and mechanical V.S. gear.

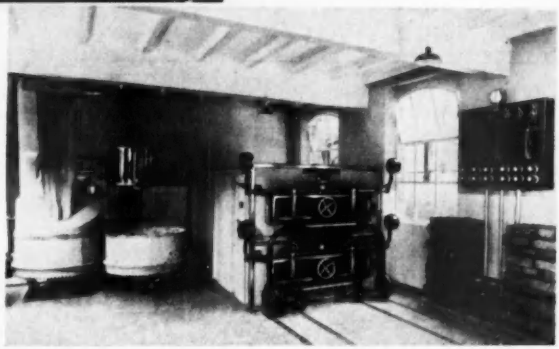
The unit is smaller and maintenance is restricted to examination of the commutator, slip-rings, brushgear and at infrequent intervals, lubrication of the ball-races. Speed can be held constant, as there is no possibility of slip such as does occur in V.S. gears. The manufacturer of such expensive machines, however, should pay particular attention to terminal ends, as it is galling to experience trouble with a first-class machine and find it to arise from so absurd a cause. Sturdy studs, contact washers, well-fitted nuts and provision for locking them are inexpensive boons to the fitter. Auto-speed control by pony motor geared to the brush-gear is a refinement and appreciated in situations where the operator is remote from the motor.

Where a long speed variation is required, the two-speed motor coupled to a V.S. gear is useful. This type requires no more maintenance than a normal squirrel-cage motor, except, perhaps, the occasional inspection of the pole-change switch. It is strong and reliable. Such a drive is eminently suited to a travelling oven intended for general work where the baking times vary over wide limits. In certain types of mixers, also, this motor can be fitted to give the necessary two speeds, one to stir together the ingredients, and the other to give the faster mixing speed.

The electro-mechanical brake, too, is useful, particularly in vertical conveyors of the chain type where a considerable load can so affect the worm-gearing that once started into motion the low-friction, squirrel-cage rotor does not come to rest. Another application is to control dough-basin tilters where a travelling nut supplies the motion. On any such installation, should the motor drive be of the vee-belt type, the brake should be fitted to the pulley remote from the motor. Otherwise, the braking effect relies on the tension of the vee-belts and should they stretch and become slackened there is the possibility of dangerous slip.



Above: Two double- and one single-deck Peel type ovens at Styans' Ltd., Sheffield. Loadings are 18 kW per deck for the double deck oven and 10 kW for the single deck



Right: Double deck drawplate oven installed at Hellesdon Hospital, Norwich. An electric dough mixing machine is seen alongside the oven

Electric Ovens

Heating, naturally, is a large part of bakery processing, and here electricity is rapidly increasing its hold. Electric ovens are essentially clean. They have a most even temperature over the entire heating surface so that rejected goods are rare from light or heavy baking. The rapidity of heating, also, is much appreciated, as they are available for operation within an hour or two should a production change be decided upon.

Moreover, they are decidedly safer than gas-fired ovens. No matter how elaborate are the safety devices fitted to gas ovens, the fact remains that a potentially disruptive force exists within an almost enclosed space.

In these days of voltage reductions and fluctuating gas pressures the safety factor under subnormal conditions must be considered. Electrically, a pressure-drop means less heat and no increase in danger.

With gas, however, the writer has witnessed a line of ovens from which the safety devices had to be removed during a pressure cut so that production could be maintained.

Oven Maintenance

Maintenance of electric baking ovens is by no means onerous, as the elements are of an area which gives good mechanical strength, and replacements are rare indeed. The operation of these ovens by means of change-over switches giving low, medium and high positions is very simple. In the effort to cut costs, particular care should be paid to the kVA meter as, with intelligent switching, considerable saving can be effected.

Travelling ovens with electrical heating are not as common as they might be, but a good measure of success has been achieved, and the number being installed is growing. The same can be said of the hot-plates used for scone and pancake baking.

Wiring Notes

As regards installation generally, it should be recognised that a modern bakery is a factory, and robust fittings are essential. Conduit, securely fixed, with metal-clad switchgear, is satisfactory, and M.I.C.C., in certain hot situations, is of great utility.

There being so many portable racks, plastic switch covers are particularly liable to damage. No matter how carefully they are placed, and guarded, it seems to be well-nigh impossible adequately to protect the essentially fragile plastic.

The top corner of a rack, smashing through the insulated cover and striking the "live" terminal is a potent source of shock danger, particularly where rubber wheels are fitted.

Most practical engineers will agree that the fully metal-clad switch-box with sunken dollies is the most useful form of fitting.

In conclusion, the modern bakery executive is becoming increasingly electricity-conscious, and before many years have passed, the all-electric bakery will be less a show-piece than a normal practice.

Photos by courtsey of the General Electric Co. Ltd.

THE WEEK in news

INDUSTRY — COMMERCE

Cable and Wireless Ltd. Transfer

STATIONS and offices of Cable and Wireless Ltd. in Great Britain were transferred to the Postmaster-General on Saturday, 1st April. As a result of arrangements announced during the passage of the Commonwealth Telegraphs Act, 1949, from that date all telegraph services operated by Cable and Wireless are being carried out by the G.P.O. Telegram acceptance and delivery facilities provided by Cable and Wireless Ltd. offices throughout the country will continue as hitherto.

Miss Margaret Leader receives the "Elizabeth Sloan Chesser Cup" from Dame Caroline Haslett at the E.D.A./E.A.W. housecraft advisers' conference. At the rear is Sir Henry Self, one of B.E.A's deputy chairmen

Relief from Profits Tax

AFTER hearing the evidence of nationalised bodies, including B.E.A., the Tucker Committee on Taxation of Trading Profits is compiling its report in private. At the closing session of the committee's hearings on Thursday all the nationalised industries claimed relief from liability to pay profits tax.

Principal complaint is that the 1947 Finance Act makes State monopolies liable to profits tax, whereas their predecessor companies or municipal concerns were exempt as statutory undertakings.

State industries are allowed to deduct from the amount on which profits tax is chargeable only that portion of the interest paid on compensation stock which corresponds to the proportion of interest paid on their non-equity capital by the former owners. Since most nationalised undertakings have large amounts of capital stock on which interest subject to taxation is paid, they are able only to obtain relief from profits tax on a small proportion of the actual interest payments.

Universities Plan Extensions

PERMISSION to proceed with the construction and equipping of new engineering laboratories has just been given to Sheffield University by the Ministry of Works. To cost £350,000 the scheme is part of the University's development plan costing several million pounds.

In Manchester last week an inquiry was opened into the Corporation's proposition to acquire three one-acre sites by compulsory purchase. If the Corporation is successful the sites will house a new electrical engineering department, arts library and Students' Union for Manchester University. First stage of the development plan will cost £1½ million.

Ferranti Meter Approved

FERRANTI'S new F.M. meter (reviewed in our March 9 issue) has been approved by the Ministry of Fuel and Power for certification in accordance with the Electricity Supply (Meters) Act of 1936.

Safety Week for Electricity?

"SAFETY FIRST," especially as regards handling of electrical equipment, would appear to be the main preoccupation of S.E. consultative council. Agitation by the council resulted in the Board issuing a notice warning consumers of the danger of amateurs carrying out electrical installations. But on Thursday, members of the council sug-

The First Half-Century

Mr. Gibbings' paper contains a certain amount of speculation as to the reasons of English backwardness in the use of electric motors. The author is dissatisfied with the explanation that it is due to our English conservatism, or to legislative and insurance restrictions, and is inclined rather to attribute it to the defects in our system of technical education. All this, however, is but introductory to the main thesis: that to educate people to the use of motors it is necessary to lend them out on hire: if customers will not take the advice of the electrical engineer, let them rig things up their own way, they are sure to come round to his opinion in the end.—*From our issue April 5, 1900.*

Princess Margaret visits Silk Street works. Photo shows (left to right) : The Right Hon. the Earl Peel (Lord Lieutenant of Lancashire), the Hon. Mrs. Gamage, the Mayoress of Salford, the Recorder of Salford, H.R.H. Princess Margaret, Mr. H. Cobden-Turner, and the Mayor of Salford

gested that the small green-printed "sticker" for attachment to consumers' electricity bills, was not forceful enough. The word danger should be incorporated, for instance, and the notice should be printed in red. Other members pointed out that "danger" would give the wrong impression, and that in red the notice might be confused with a final demand.

Alderman B. Watson wanted to carry the whole matter a stage further. Why not a safety week for electricity on the lines of the road safety week? Legislation was already catering for the safety of the worker, but it was impossible for anything similar to be applied to the home. Through the medium of films, broadcasting, television and schools, people should be educated in the corect use of electrical appliances. The chairman, Mr. M. A. Bulloch, agreed to refer the discussion to the Board.

"Tax on Cleanliness"

A SECOND letter urging removal of purchase tax from electric appliances has been sent to all M.P.s by E.D.A. The letter claims that the Ministry of Works' report *An Inquiry into Domestic Water Supply in Great Britain* gives emphasis to the Association's memorandum on "the Case for the Removal of P.T. from Domestic Electric Appliances", circulated to all M.P.s on Feb. 28.

Particular attention is drawn to the statement in the report "Among the piped appliances the immersion heater is considered satisfactory by the highest proportion of housewives—89% of those having them." The letter stresses that although independent boilers only take second place they are not subject to any tax, while tax on immersion heaters continues at 100% and on storage appliances, 66⅔%.

Urging M.P.s' support for withdrawal of P.T. on electric appliances, Mr. V. W. Dale, E.D.A., comments, "The retention of purchase tax is, in effect, a tax on cleanliness."

Princess visits Electrical Works

DURING a four-day visit to Lancashire last week, H.R.H. Princess Margaret visited the works of Salford Electrical Instruments Ltd., a subsidiary of G.E.C. Her Royal Highness was received by Mr. H. Cobden-Turner, managing director, and Mrs. Cobden-Turner, and, on behalf of G.E.C., Mr. Leslie Gamage and the Hon. Mrs. Gamage. The Princess was shown a selection of the company's wide range of equipment, and displayed particular interest in the manufacture of synthetic sapphires.

Indonesian Trade Talks

SUCCESSFUL trade talks between the U.K. and Indonesia were concluded in London last week. This year Indonesia will export to us commodities worth about £12 millions. Indonesia's imports from the United Kingdom during 1950 will continue to be limited owing to her balance of payments difficulties. Quotas will be made available for U.K. exports up to a total value of over £7 millions, electrical equipment being one of the chief items.

£4,229 Claim against Eastbourne

THE Eastbourne Corporation has been served with a writ, issued by the British Electricity Authority and the South-Eastern Electricity Board, claiming payment to them by the Corporation of an amount of £4,229. This sum, it is alleged, was transferred by the Corporation in 1947-48 from the unappropriated profits of the electricity undertaking in aid of the general rate prior to the vesting of the undertaking in the plaintiffs.

The Corporation Finance Committee has recommended that the town clerk be authorised to take the necessary steps to defend the action.

Power Problems in Germany

FOR THEIR March luncheon the Batti-Wallahs' Society "came ashore" for a guest, and entertained Major-General E. O. Herbert, C.B., C.B.E., D.S.O., now Director-General of the Territorial Army. General Herbert was the British Commander in Berlin during the blockade last year, and he had an interesting story to tell of the problems that had to be met.

Berlin West power station had been effectively dismantled by the Russians during the short period they were in occupation at the end of the war, and the only generating plant available in the western zone was that in a few obsolescent stations normally reserved for peak load operation. When the blockade began, power supplies from the Russian Zone were quickly cut off, and these western sector stations had to operate continually so far as was possible. To this end firing methods were changed and many severe economies enforced.

Some retaliation against the Russians was possible since some important distribution circuits supplying the eastern sector ran through the British controlled area.

Towards the end of his talk, General Herbert turned to the expansion of the Territorial Army, and appealed for the support of employers in encouraging experienced men to volunteer in the next few years.

S.W. Board Reorganises

RE-GROUPING of S.W. Board's area took place with effect from Saturday, April 1. The number of sub-areas is reduced from five to four. Taunton, Exeter and Torquay sub-areas are being merged into two organisations centred on Taunton and Exeter to be known respectively as the Taunton and Devon sub-areas. Bristol and Cornwall sub-areas remain unchanged.

Decision to re-group the sub-areas has been taken because certain commercial and engineering functions have been transferred from sub-areas to district managers. As a result of the move sub-area managers will have more time to concentrate on their task of supervising and co-ordinating the work of districts. Rearrangement of personnel will also reduce the Board's management costs.

Grouping of districts in the new sub-areas will be:

Taunton: Barnstaple, Bridgwater, Bridport, Crewkerne, Exe Valley (District office, Tiverton), Minehead, and Taunton.

Devon: East Devon (District office, Exeter), Exeter, Plymouth, Torbay, and West Devon (District office, Bideford).

Window Display Winners

FIRST PRIZE and the area challenge cup in S.W. Board's window display competition has been won by Dartmouth service centre. Second prize was taken by Bristol, Colston Avenue, and Bideford was placed third. After visiting fifteen centres during two days last week the judges, Mr. H. G. Davis, display manager for Brights of Bristol, and Mr. A. J. Symes, editor of *Display, Design and Presentation*, announced the result.

They also highly commended the display at Burnham-on-Sea and commended those at Taunton, Exeter, Lynton, Bude, and St. Ives. In the preliminary round of the competition there were 87 entries from 65 different service centres.

Railways tighten Claim Procedure

PART OF a campaign being waged by British Railways and Trading Associations to reduce pilferage of goods in transit, the railway executive has decided to revert to the statutory time limits for lodging complaints and claims in respect of partial loss, damage, deviation, misdelivery, delay or detention of traffic consigned on or after June 1, 1950. After that date complaints should be advised in writing to British Railways within three days of termination of transit, and a written submission of claim must be made within seven days.

During the war, because of postal and staff difficulties, the statutory periods were extended to seven days and 28 days respectively. For the present, no change is being made in the extended periods applicable to non-delivery of the whole or part of a consignment.

Overseas Fairs feature Electricity

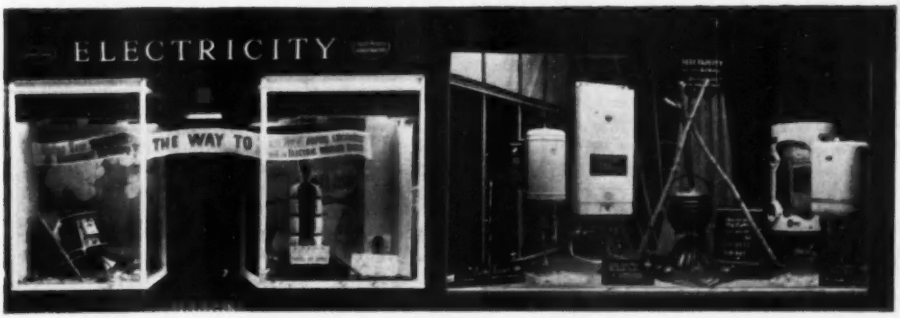
PRELIMINARY details have just been issued of the part electricity is to play in two European trade fairs to be held during May. At the first, the Foire Internationale de Liege (April 29-May 14), the number of electric and electronic apparatus exhibitors has caused the organisers to group them together. The complete exhibit will almost fill the "Palais de la Liberation."

Some 450 electricity stands at the Paris International Trade Fair (May 13-29) will be grouped together, with smaller exhibitors clustered round twenty large firms. One of the novel attractions on show will be an apparatus utilising ultra-sound waves for protection of premises against intrusion.

Power Restrictions Off

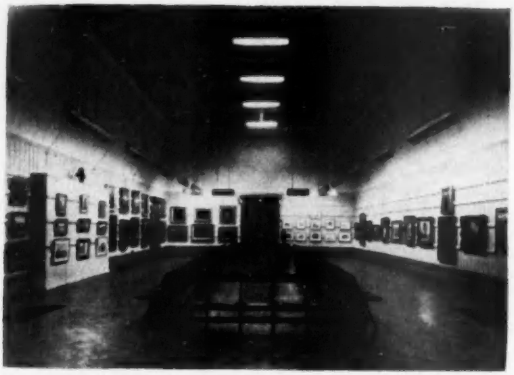
PLANS FOR next winter's electricity supply were discussed on Thursday, by the electricity sub-committee of the Ministry of Labour's joint consultative committee. Their report is to be

Winning displays in S.W. Board's competition. Left: Dartmouth (1st); right: Colston Avenue, Bristol (2nd)



published as a White Paper, probably in June this year.

Restrictions on use of electricity for shop window, advertisement and other lighting ended on March 31, and remains off until October 9. Domestic consumers will still be required to economise during peak periods.



Camberwell's Fine Art Gallery is now lit by "Atlas" units installed by A. S. Evans

Coal-Driven Gas Turbines

EXPERIMENTS to examine the use of coal as a gas turbine fuel are being carried out by the British Coal Utilisation Research Association. A combustion chamber burning 200 lb. coal per hour is now operating. Designed on the cyclone or helix principle, the products of combustion are diluted with air to give gases at temperatures suitable for use with a gas turbine. Combustion takes place partially on slag-coated walls, the combustor being mounted over a mixing chamber in which any surviving ash particles are chilled.

In the first stage the work has been carried out at atmospheric pressure, to provide necessary design data for construction of a pressurised combustion chamber. The experimental set-up is elaborate and comprises air blowers, gas-fired air pre-heaters, air dilution fans, cyclones for removing dust from the combustion gases, and apparatus for adjusting the rate of coal feed.

B.C.U.R.A. is also engaged in research on smokeless combustion of bituminous coal. New systems of recirculating flue gases may soon prevent the formation of soot particles as well as reduce the deposit on the heating surfaces of high-efficiency boilers.

Technical Mission to America

THREE TECHNICAL missions, comprising, altogether, 110 European inland transport experts, will shortly leave for the United States. First mission with 40 members will study carriage and storage of perishable goods, noting in particular the special techniques developed by Americans for transporting fresh fruit from California to the great cities of the East.

The second mission, also composed of 40 members, will investigate the most recent developments in railway electrification, utilisation of diesel locomotives, modernisation of stations, and omnibus connections. During its six-week stay, it will pay special attention to arrangements for passenger comfort—for lighter and better ventilated carriages fitted with movable seats.

Third mission, with 30 members, will attend a series of lectures on highway improvement in Washington from May 5 to September 2.

Cookery for Deaf and Dumb

BELIEVED to be the first cookery demonstration of its kind in electricity supply, about 60 people attended a recent demonstration and film show at Burnley Deaf and Dumb Institute. Under arrangements made by Burnley district staff, N.W. Board, cookery was demonstrated by Miss S. Downie, assisted by Miss Corke. Electrical and entertainment films were shown before and after the demonstration, and the demonstrators' remarks were interpreted by sign language and the main points noted on a blackboard.

Conference on Photography

EXPERTS on photography by invisible radiation are to discuss the subject in a one-day conference arranged jointly by the Scientific Film Association and the Royal Photographic Society. Opening at 10 a.m. on Saturday, April 15, the conference is to be held at London University Institute of Education, Malet Street, W.C.1. Papers, divided into groups, will cover ultra-violet, infra-red and X-ray radiation. Fee for non-members is £1, and applications should be made to the Scientific Film Association, 4 Great Russell Street, W.C.1.

NEWS IN BRIEF

Ekco-Ensign Electric, Ltd., have received an order from the U.S.A. High Commissioner's Office in Germany for 10,000 projector lamps, to be used in the Film Education Service operated by the occupying powers.

Second of three booklets on marketing of British goods in United States and Canada, *Advertising Sales and Promotions*, has just been published by the Dollar Exports Board.

Portugal has prohibited import from U.K. of l.t. switchgear, rubber insulated conductors (except armoured underground cable), electric motors between 1 and 30 h.p., starting and control gear for motors (except special cases), switchboards and switches (except special cases).

Best paper on research into welding or its applications submitted to the Welding Research Association, 29 Park Crescent, W.1, will win a prize of £100.

During 1949, £76 was collected at the Batti-Wallah's monthly luncheons for E.I.B.A. funds.

A popular magazine pre-war, *Electrical Housekeeping*, published by E.D.A., reappears this Easter, obtainable free from Area Board service centres.

Bexhill power station staff commemorated 25 years' working of the undertaking with a supper and smoking concert recently.

Accompanied by B.T.H. executives, the Third Sea Lord and Controller of the Navy, Vice-Admiral M. M. Denny, toured the Rugby works last week.

Seeboard—S.E. Board—are running a special sales drive for electric water heaters, and a series of five advertisements is to appear in local newspapers in their area.

The Ministry of Fuel and Power has issued a general reminder to electricity consumers that all restrictions on the use of electricity in business, offices, etc., for shopwindow, advertisement and other display lighting are removed during the period 1st April until 9th October next.

Questions in Parliament

Purchase Tax Lost

The Chancellor of the Exchequer was asked whether, in cases where purchase tax was reduced or remitted on any article, the retailer thereby incurring a loss, he would in future make provision whereby the retailer could recover the difference in the tax which he had already paid. Sir Stafford Cripps replied that up to the present it had not been possible to devise, in consultation with the trade, a fair and workable solution of this difficult problem. Efforts were still being made to devise a satisfactory system. Later, Mr. Storey suggested that traders should be given a discount of 10% when paying their purchase tax amounts, to compensate for loss through p.t. paid either on goods which become unsaleable or upon which the tax was removed or reduced. Sir Stafford said he could not contemplate such a course.

Volta River Scheme

Questioned as to when the report would be available on the suitability of the Volta River project in the Gold Coast as a sterling area source of aluminium, Mr. Griffiths said a survey of the potentialities of the river was at present in progress; this covered not only the possibility of developing hydro-electric power but also the requirements of irrigation and navigation. The report of the survey was not expected for several months, but he would endeavour to expedite it.

Lighting near Airfields

Lt.-Col. Bromley-Davenport asked the Parliamentary Secretary to the Ministry of Civil Aviation if he was aware that the Wilmslow U.D.C. would be obliged to spend an additional £1,000 in order to adapt its proposed new street lighting system to the requirements of his department, and if a contribution towards the cost would be made. Mr. Beswick replied that where existing lights need to be modified to meet air navigation requirements, the granting of an *ex gratia* contribution would be considered. The matter was being examined.

Kirkstall—Grit Nuisance

Asked what further progress had been made to nullify the grit and dirt nuisance from the chimneys of Kirkstall power station, Mr. Noel-Baker said a new chimney should be completed this year and new electrostatic precipitators and ash handling plant should be in operation next year.

Condenser at Hull

When Mr. W. R. Hudson asked the Minister of Health if he was aware that a condenser recently erected at Sculcoates, Kingston-upon-Hull, was the cause of ill-health and inconvenience to residents, Mr. Bevan replied that he had no information on such complaints, and wished to receive further particulars.

Grit Plant, Southampton

Replying to Dr. King, the Minister of Fuel and Power stated he understood the B.E.A. had received tenders for the installation of grit arresting plant at the Southampton generating station, and a contract would soon be let. It was not considered likely, however, that the work would be completed before September, 1951.

Uganda Projects

When asked by Mr. J. Hynd, for news of the progress to date of the Uganda hydro-electric scheme and the prospects of the development of new industries dependent on the project, Mr. Griffiths stated that the contract for the erection of the dam and h.-e. station was placed in September last, and preliminary work on the site has begun. It was too early to give a detailed forecast of industrial development in the Jinja area, but projects for the manufacture of cotton textiles, fertilisers, paper, building materials and iron and steel were among those being considered. A cement factory had been started at Tororo, and would eventually draw its power from Jinja.

P.O. and Telegraph Bill

When the Post Office and Telegraph (Money) Bill was considered in committee last week, some members made further criticism, but after discussion it was read the third time.

Electric Supply News

Belfast

A preliminary report on the negotiations taking place between the Ministry of Commerce and the Belfast Corporation Electricity Committee for Government sanction of a £422,300 loan, which the Committee want to raise, was given by the city electrical engineer, Mr. M'C. Girvan, at a special meeting of the Committee recently. The Committee propose raising the loan to meet the estimated cost of the distribution system for the year ending March 31, 1951.

Coventry

Plans have been made by the West Midlands Area Gas Board, for the installation of a gas-turbine generator at Coventry gasworks, which will utilise waste gases eliminated in the coal-gas producing process in standard type retorts. Of the closed cycle type, the 700 kW turbine is to be built by John Brown Ltd., and is planned to be in operation in 1952. It is expected that the set will generate sufficient electricity to meet the needs of the gasworks, and also to augment supplies to the West Midlands Electricity Board.

It may be recalled that, prior to nationalisation, the Coventry Corporation approved a scheme for the installation of plant at the Foleshill gasworks for the utilisation of waste heat for the generation of electricity. We noted that plan in our October 14, 1948, issue. Estimated cost of the scheme at that time was put at £69,650.

Colyton

Residents are petitioning the South-Western Electricity Board to take over the local undertaking and to provide a full and satisfactory supply of electricity as soon as possible, and before 1950-51.

East Midlands Board

Mr. C. R. King, chairman, has said that the rebate to consumers who paid the Clow surcharge would be in the region of 0·15d. p.u. The Board has introduced an assisted wiring scheme (credit sales) as yet applicable only to premises in rural areas.

Eastern Board

While poles and steel work are coming through in better quantities, a shortage of skilled labour is now holding up electricity development in rural areas, the Executive of the West Suffolk Parish Council's Association was told at Bury St. Edmund's recently by a representative of the Eastern Electricity Board.

Inverness

The area manager of the North of Scotland Hydro-Electric Board has asked the Committee to consider utilising electricity to a full extent (cookers, boilers, etc.) in future Corporation houses. He estimated that for an all-electric four apartment house the cost would be 4s. 8d. per week. At the recent council meeting the advantages and disadvantages of all-electric houses were considered, and it was decided to meet the area manager to discuss the matter.

London Board

A further rebate of 0.18d. per unit is to be given by the Board to domestic consumers to whom the 1948/49 winter surcharge applied. It will apply during the second quarterly period of 1950.

North of Scotland

Another tunnel in the Loch Sloy hydro-electric scheme was completed last week, when the last charge of 200 lb of gelignite was fired to complete the 7,500 ft tunnel, which is the longest single-cut tunnel in the scheme.

South Wales

The South Wales Electricity Board has now announced that a rebate of 0·1d. p.u. on accounts for the June quarter, 1950, is to be given to domestic consumers to whom the Clow surcharge applied.

LIGHTING SCHEMES

Bamburgh.—The parish council has approved a scheme to provide the village with 18 street lights, at a cost of £587.

Ellesmere Port.—The surveyor is to prepare a scheme for sodium lighting on the main road from Hootton Cross Roads to Great Sutton.

High Wycombe.—The T.C. has agreed to the installation of street lighting in Hughenden Road, at an estimated cost of £2,500.

Horley (Surrey).—The Public Loans Board has granted a £5,000 loan to replace gas lamps by electricity.

Hyde.—The Highways Committee has approved an estimate of £9,800 for sodium lighting in certain roads.

Lockerbie.—A scheme of electric street lighting has been approved by the M.o.T.

Long Eaton.—A scheme of street lighting in Tamworth Road, costing £4,000, is to be completed this year.

Middlesbrough.—The T.C. has approved proposals for the change-over of street lighting from gas to electricity. The borough engineer's report estimates the cost, spread over 15 years, at approximately £310,200.

Morecambe.—To encourage owners of private premises to illuminate their buildings during the coming season, the Corporation is offering prizes up to £500.

Nuneaton.—The T.C. has been recommended to approve in principle a scheme for the installation of fluorescent lighting in the town centre. Estimated cost £4,303.

Pontefract.—Street lighting, comprising 37 250-W mercury vapour lamps, was switched on a short time ago.

Company Activities

Bakelite Ltd.

Preliminary details for the year ended December 31, 1949, show group profit, after all charges, except taxation, and after crediting amounts specially provided in previous years of £45,407 (*£40,443*), amounted to £200,275 (*£247,724*). Taxation, as reduced by initial allowances relief amounting to £40,000 (*£15,000*), absorbed £51,542 (*£100,456*). Profits available for appropriation £148,733 (*£147,268*). Interim dividend of 5% (6%), and proposed final 13% (*12%*) absorbs £74,250 (*same*).

British Aluminium Co.

The statement records a group trading profit for 1949 of £1,538,359 (*£1,845,677*). There is a final dividend of 6%, making 10% (*same*). Investment income was £54,434 (*£103,031*), profit on sale of trade investments £143,228 (*£140,265*), profit on exchange £67,574 (*nil*), bringing the total to £1,803,595 (*£1,518,217*). Tax absorbs £478,262 (*£782,578*), and after providing £774,130 (*£807,945*) for depreciation, interest and other charges, the group net profit is £551,203 (*£498,450*), of which £548,560 (*£496,081*) is attributable to the parent company and £2,643 to outside interests. To general reserves £125,000 (*£204,000*), and to income tax equalisation reserve £145,000 (*nil*). Dividends to parent company again require £214,500, while £30,860 (*£35,522*) is credited to contingencies reserve, leaving £733,543 (*£700,343*) carried forward.

A. F. Bulgin & Co.

Trading profit for the year to January 31 last was £61,061 (*£61,415 for one year and 12 days*), plus interest £25 (*£384 interest and surplus on sales of motor vehicle*), making £61,086 (*£61,799*). Depreciation takes £2,260 (*£2,675*), directors' emoluments £9,075 (*£9,103*), audit fee £315 (*£325*), registrars' fees and expenses £375 (*£368*), leaving net profit, before tax, of £49,061 (*£49,328*). Taxation absorbs £30,000 (*£27,515*), 25% dividend already recommended £13,750 (*£15,125*), preliminary expenses written off nil (*£1,457*), leaving £10,541 (*£5,231*) carried forward.

Lancashire Dynamo & Crypto

Net profit for 1949 was £136,561 (*£130,008*). A second interim dividend and bonus of 17½% (*same*), makes 22½% (*same*).

R. B. Pullin, Ltd.

The full account shows a consolidated trading profit for the year to September 30 last of £39,420 (*£6,615*), plus sundry credits £39,420 (*£6,615*), making £78,957 (*£8,330*). This was after charging depreciation £8,646 (*£10,771*), directors' fees £1,700 (*£1,575*), directors' emoluments £6,729 (*£6,274*), directors' pensions fund £257 (*£237*), and interest £4,091 (*£5,158*). To taxation £21,038 (*£16,330*), reserve for dilapidations £100 (*same*), leaving net profit £57,819 (*loss £8,291*). To 10% dividend for 1947-48 £5,500 and 10% 1948-49 £5,500, leaving debit forward of £14,009 (*£60,828*).

A. Reyrolle & Co.

The preliminary statement shows a net profit for 1949, subject to audit, of £587,207 (*£303,381*). Final dividend is again 7½%, making 15% (*12½%*). Provision for U.K. taxation is £713,585 (*£371,656*).

Superheater Co.

Net profit for 1949 was £163,301 (*£139,693*). Recommended final dividend of 19% on the Ordinary and "A" Ordinary shares on a capital increased by a 33⅓% bonus, making 39%. For 1948, the total distribution was 45%.

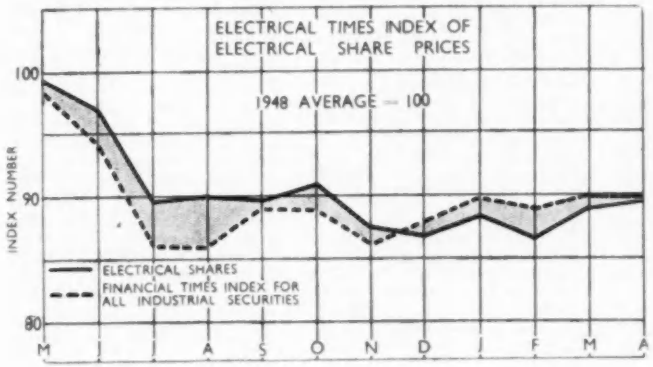
Switchgear and Cowans, Ltd.

The consolidated balance sheet shows current assets at £477,632 (*£429,198*), less current liabilities, including £107,342 (*£110,898*) owing to bankers of £234,967 (*£252,155*).

Dividends Declared

Aerialite, Ltd. Interim dividend of 62½% (*same*).

Crompton Parkinson. Interim dividends of 4% on first preference stock and 3% on the second preference stock.


ELECTRICAL TIMES INDEX OF ELECTRICAL SHARE PRICES
1948 AVERAGE = 100
INDEX NUMBER
100
90
80
ELECTRICAL SHARES
FINANCIAL TIMES INDEX FOR ALL INDUSTRIAL SECURITIES
M J J A S O N D J F M A

Electrical share prices continued to rise during March. Calculated from the quoted prices of Ordinary shares of 19 electrical companies at the beginning of the month, the Electrical Times index rose 1·2% to 88·3% of the 1948 average. Corrected on the same basis, the Financial Times index remained at the same percentage as last month, namely 88·86%.

Commercial Information

CONTRACTS OPEN

HOME

Apr. 7.—Blaydon U.D.C. Electrical fittings and cable to be delivered to Neighbourhood Unit, Lichfield Lane building sites, Winlaton. Housing Surveyor, Council Offices, Blaydon-on-Tyne.

Apr. 8.—Dartmouth T.C. Installation of electric lighting and socket points in 73 houses at Britannia Avenue, Dartmouth. Borough Engineer, 12 Victoria Rd., Dartmouth.

Apr. 8.—Perth T.C. Electrical equipment for Cleeve children's home. R. Adam, Town Clerk, City Chambers, Perth.

Apr. 10.—Coupar Angus T.C. Electrical work for 10 houses. Town Clerk, A. F. Laing. National Bank Buildings, Coupar Angus.

Apr. 10.—Glasgow T.C. Twelve months' supply of electric cable, etc. Office of Public Works, (Room 81), City Chambers, Glasgow C.2.

Apr. 10.—Luton T.C. 37 concrete lighting columns and lanterns and lanterns complete with equipment to be installed at Eaton Green Road Division. Borough Engineer, Town Hall, Luton.

Apr. 11.—Radcliffe T.C. Installation of electrical services in 58 houses and 4 flats on Outward housing estate. Borough engineer and Surveyor, Town Hall, Radcliffe. Deposit £1 1s.

Apr. 11.—Whiston R.D.C. Installation of electric lighting and power at two houses in Mill Lane, Bold, and five at the Roundabout, Cronton. W. H. Bone, Chief Sanitary Inspector, Council Offices, Delph Lane, Whiston.

Apr. 12.—Manchester T.C. Electrical installation for police divisional headquarters at St. Joseph's Buildings, Longsight, Manchester. City Architect, Town Hall, Manchester. Deposit £1 1s. (Advertised in Mar. 30 issue.)

Apr. 12.—Dublin. Electrical works and supplies in district for one year from May 2, for Commissioners of Public Works. T. J. Morris, Secretary, Office of Public Works, Dublin.

Apr. 13.—Belfast. Three industrial type electric floor polishing machines for AnnadaleGrammar School, Annadale Embankment, Ashfield Grammar School, Circular Road, and the Education Offices, Belfast. Education Offices (Room 5), Academy Street, Belfast.

Apr. 14.—Belfast T.C. Renewal and re-adjustment of 33 kV, 750 MVA and 500 MVA switchgear and accessories for existing Reyrolle switchgear. Merz and McLellan, Consulting Engineers, Carliol House, Newcastle-upon-Tyne 1. Deposit £5 5s. (See our Mar. 16 issue.)

Apr. 14.—Stockport T.C. 148 pre-cast concrete columns, lanterns and 250 W mercury vapour lighting equipment. Wm. F. Gardner, Borough Surveyor, Town Hall, Stockport. (See our Mar. 30 issue.)

Apr. 14.—Sunderland T.C. Electrical installation for Hill View primary infants school. Architects, Matkin and Hawkins, Barclay Chambers, Fawcett Street, Sunderland. Deposit £1 1s.

Apr. 15.—Lewes T.C. Wiring in conduit for lighting points in public conveniences, Weston Rd. C. T. Butler, Borough Surveyor, Town Hall, Lewes.

Apr. 15.—Manchester T.C. Repairs to electrical installation after war damage at Burnage High School for Boys, Levenshulme. City Architect, Town Hall, Manchester. Deposit £1 1s. (See our Mar. 16 issue.)

Apr. 15.—Manchester T.C. Oscillograph equipment, laboratory instruments, audio-frequency oscillators, and relays for Municipal College of Technology extension. Principal College of Technology, Manchester 1. (Advertised in this issue.)

Apr. 15.—Oldbury T.C. High pressure mercury vapour electric discharge lighting on Birmingham-Wolverhampton Road between Birchfield Lane and Borough boundary at Bury Hill. Borough Engineer, Municipal Bank Chambers, Oldbury. Deposit £2 2s.

Apr. 15.—Samford R.D.C. Installation of 19 electric cookers on council's housing sites. Building Surveyor, Council Offices, 25 London Road, Ipswich.

Apr. 17.—Nottingham T.C. Replacement of electrically driven booster pumps at Normanton-on-the-Wolds. B. W. Davies, Engineer and General Manager, Water department, Castle Boulevard, Nottingham.

Apr. 17.—Portrush. Electrical installation on behalf of N. Ireland Hospitals Authority at Hopefield hospital, Portrush. F. W. Parkinson and Partners, 93 Ann Street, Belfast.

Apr. 18.—Kingsclere and Whitchurch R.D.C. Electrically driven booster pump for Ashmansworth pumping station. Council's Surveyor, R. A. Over, Council Offices, Kingsclere, Berks.

Apr. 18.—Kirkcaldy T.C. Electrical work for 36 flats at Winifred Crescent. J. Gentles and Son, 162 High Street, Kirkcaldy.

Apr. 19.—Southport T.C. Electrical installations in 18 houses to be erected at Site No. 12, Grantham Rd. Borough Engineer, Town Hall, Southport.

Apr. 20.—Lockerbie T.C. Provision of street lighting on trunk road A74, comprising erection of 47 columns, brackets, lanterns and 140 W sodium electric discharge lamps. G. Stevenson, Town Clerk, Town Hall, Lockerbie. Deposit £2 2s. (See our Mar. 23 issue.)

Apr. 21.—Bournemouth T.C. Installation of 2 pairs of electrically operated passenger lifts each capable of carrying 30 passengers for use on sea front at Woodland Avenue, Southbourne, and Manor Road West. Borough Engineer, Town Hall, Bournemouth. Deposit £2 2s.

Apr. 22.—Consett U.D.C. Network for provision of street lighting. T. Hutton, Surveyor, Council Offices, Medomsley Road, Consett, Co. Durham.

Apr. 24.—Lincoln C.C. Maintenance of electric refrigerators, potato peeling machines, and

mixing machines, for education committee. J. E. Blow, Clerk of the County Council, County Offices, Sleaford, Lincs.

Apr. 28.—Belfast T.C. 6,600 V and 400 V auxiliary switchgear and accessories for Harbour power station. Merz and McLellan, Consulting Engineers, Carliol House, Newcastle-upon-Tyne 1. Deposit £5 5s. (See our Mar. 23 issue.)

Apr. 28.—Manchester. New electrically operated passenger lift for College of Technology. The Chairman, College of Technology Sub-committee, Education Offices, Deansgate, Manchester 2.

Apr. 28.—Reigate T.C. Electrical rewiring of Town Hall. G. G. Sanderson, Borough Surveyor, Town Hall, Reigate. Deposit £2. (Advertised in this issue.)

May 1.—Metropolitan Water Board. Five electrically driven inclined spindle low lift pumps for pumping station at Chingford South Reservoir. Chief Engineer's department (Room 122), Officer of the Board, New River Head, Rosebery Avenue, E.C.1.

May 1.—N. Scotland H.E. Board. Erection of 8¼ miles of 33 kV single-circuit wood pole overhead lines near Killin, Perthshire. Engineers: Merz and McLellan, 39 Northumberland Street, Edinburgh 3. Deposit £1 1s. (Advertised in this issue.)

May 1.—N. Scotland H.E. Board. 11 kV and lower voltage single circuit wood-pole overhead distribution lines in the parish of Kilmarnock, Dunbarton. Engineers: Merz and McLellan, 39 Northumberland St., Edinburgh 3. Deposit £1 1s. (See our March 30 issue.)

No date stated.—Cockermouth U.D.C. Electrical wiring of 77 houses on Moor and Kirkbank housing estates. Surveyor, M. M. Dixon, Town Hall, Cockermouth.

No date stated.—Denbighshire Education Authority. Electric lighting installation at new primary school at Wrexham. County Architect, Grove Park, Wrexham. Deposit £3. (Applications by Apr. 10.)

No date stated.—Hartlepool T.C. Installation of electric lighting in 29 houses at West View. R. H. Snowball, Borough Engineer, Borough Buildings, Hartlepool.

No date stated.—Carlisle T.C. Electrical installation in 40 flats. L. J. A. Stowe, City Engineer, 18 Fisher Street, Carlisle.

No date stated.—Seaton Valley U.D.C. Electrical goods required for 34 houses on Blyth Street estate. T. W. Burgess, Surveyor.

No date stated.—Linlithgow T.C. Electrical work for 24 houses to be erected at Mains Maltings site, Linlithgow. N. S. Main, Town Clerk, Linlithgow.

OVERSEAS

*Details of items marked * may be obtained on application to Room 1076, Board of Trade, Thames House, North Millbank, S.W.1, quoting reference.*

Apr. 12.—Australia. 6,600 V switchgear fuses and lightning arresters for Mackay City Council. Specification No. 183. 6,600 V armoured cable and outdoor type cable boxes. Specification No. 182, State Electricity Commission, Brisbane.

Apr. 12.—Brisbane. 1,500 yds of 6,600 V armoured cable, cable end sealing boxes (outdoor and indoor). The Secretary, State Electricity Commission, Scottish Union House, Eagle Street, Brisbane. B.o.T. (Ref. CRE (IB) 47207/50).*

Apr. 12.—Brussels. 3 sets of storage battery charging units enclosed, ventilated, 220 V 3-phase 50 periods, or 380 V 3-phase 50 periods. Belgian State Railways. B.o.T. (Ref. CRE (IB) 46836/50).*

Apr. 12.—Queensland. Galvanised insulator pins, cross arm braces, pole caps, galvanised bolts and nuts, washers, and disc insulator fittings, and clamps for Wide Bay Regional Electricity Board. Secretary, State Electricity Commission, Scottish Union House, Eagle Street, Brisbane. B.o.T. (Ref. CRE (IB) 47199/50).*

Apr. 12.—Queensland. 48 6/6 kV lightning arresters, 48 6/6 kV drop-out expulsion fuse switches, 65 6/6 kV air break switches, and 56 l.t. switch fuses (300 amp rating). State Electricity Commission, Queensland. B.o.T. (Ref. CRE (IB) 47295/50).*

Apr. 13.—Uruguay. Two private branch automatic exchanges and telephones. Administracion Nacional de Combustibles Alcohol y Portland. B.o.T. (Ref. CRE (IB) 46077/50).*

Apr. 14.—Wellington. Voltmeters, ammeters, microammeters and milliameters. New Zealand Post and Telegraph Department. Director-General (Stores Division), General Post Office, Wellington, C.1.

Apr. 14.—Bangalore. 15 miles underground cable, 3-core, 5,000 V, 4-way outdoor type h.t. feeder pillar units, 106 straight joint boxes, 4 tee-boxes, 7 pot-heads and jointing acces-

Your Queries Answered

"Kaloric" convector heaters, makers of? E.S.—M. and J. Lossos and Co., Ltd., 31 Beethoven Road, London W.10. (17891)

"Polocast" conduit fittings, makers of? T.E.—Alexander Pollock and Co., 14 Antiga Street, Edinburgh 1. (17896)

"Sewmac" sewing machine motors, makers of? T.E.—Sewmac Services, Ltd., 51 Oxford Road, Manchester. (17899)

"Century" motors, makers of? T.E.—Asea Electric, Ltd., Fulbourne Road, London E.17. (17905)

"Surves-Servis" cookers, makers of? H.P.—Falk Stadelman and Co., Ltd., 91 Farringdon Road, London E.C.1. (17909)

"Shanks" grass driers, makers of? T.E.—Harvest Saver and Implement Co., Ltd., The Works, Kirby Moorside, York. (17914)

"JP" electric lawn mower, makers of? T.E.—J. P. Eng. Co., Ltd., Meynell Road, Leicester. (17919)

"Longlite" architectural lamps, makers of? W.—British Thomson Houston Co., Ltd., 44 Fitzroy Road, London N.W.1. (17924)

The above are selected from questions we have answered this week. If you have a query, send it to us.

ANSWER WANTED

Switch blocks, metal rimmed, makers of? S.E.

sories. Govt. of Mysore Stores Purchase Committee, Bangalore, India. B.o.T. (Ref. CRE (IB) 46915/50).*

Apr. 15.—Syria. Various types underground telephone cables. Director-General of the Syrian Posts, Telegraphs and Telephones, Damascus. B.o.T. (Ref. CRE (IB) 46341/50).*

Apr. 27.—Australia. 11,000 V. 260 MVA metal-clad switchgear for Mascot substation. Specification 1363. Deposit £150. Comptroller of Stores, Old Electricity Building, St. Andrew's Place.

PRICES OF CABLE METALS AND OTHER MATERIALS
(at Tuesday night)

	£ s. d.	New York price
COPPER, electrolytic	153 0 0	£140 0 0
Delivered in 2nd and 3rd month after order	155 10 0	—
Delivered in 4th, 5th and 6th month after order	158 0 0	—
LEAD, good soft pig (foreign)	84 0 0	84 0 0
" " " "English" quality	85 10 0	—
Delivered in 2nd and 3rd month after order, plus	2 0 0	—
TIN (99·99·75%) (Cash)	582½-583	—
" (3 months)	584½-584½	—
ALUMINIUM, commercial purity (del.)	112 0 0	—
ZINC	91 10 0	84 0 0
ARMOURING:		
Galv. Steel Wire (0·104 in.)	39 10 0	—
Mild Steel Tape (0·04 in.)	26 0 0	—

CONTRACTS PLACED

Lamps. Supply of lamps to Poplar T.C., Gosport T.C., and Hemel Hempstead T.C. Thorn Electrical Industries, Ltd.

L.C.C. Six electrically-driven sludge pumping sets: Hamworthy Engineering Co., Ltd., £5,007 (later increased to £5,501 because of further provisions in the contract); Gwynnes Pumps, Ltd., £6,149; W. H. Allen Sons and Co., Ltd., £6,596.

Maidstone T.C. Wiring 86 houses on Shepway estate. Charles Walter, Ltd. £2,270 (recommended).

Northwich U.D.C. Electrical installation on Manor Park estate. Gorst and Oakes, £2,206.

Skegness U.D.C. Installation of illuminations at southern section of boating lake, etc. R. Butler, £6,500.

TRADE NOTES

Acquisition.—The assets and works of STAMFORD ELECTRICAL, LTD., at Barnack Road, Stamford, Lincs., have been acquired by ARTHUR LYON AND CO. (ENGINEERS), LTD. It is understood that the works are to be reorganised, and, in addition to the manufacture of similar goods as in the past, fresh production will be introduced to the limit of the factory's capacity.

B.E.A.M.A. Contract Price Adjustment Formulae.—For purposes of calculating variations in: (*a*) "Rates of Pay"; the rate of pay for adult male labour at March 11, 1950, shall be deemed to be 115s.; (*b*) "Costs of Material": the index figure for intermediate products last published by the Board of Trade on March 11, is 277·3 and is the figure for the month on February, 1950.

Change of Address.—The offices of the ELECTRICAL FAIR TRADING COUNCIL were last week moved to Sardinia House, Kingsway, W.C.2. The telephone number remains unchanged—Holborn 4538.

Zinc Price.—As from April 4, the price of zinc was raised a further £2 to £91 10s. a ton, delivered.

Exide Sales H.Q.—New S.E. Area headquarters for the sale and distribution of Exide and Drydex batteries have been established at Abbey Road, Park Royal, N.W.10.

London Office.—The POWER CENTRE CO., LTD., has opened a London office at Wellington House, 125-130 Strand, London W.C.2. Tel.: Temple Bar 1743, under the management of their technical engineer, Mr. E. K. Guy.

New Branch.—C. A. PARSONS AND CO., LTD., announce that they have opened an office at 3 Royal Chambers, Park Place, Cardiff. Tel.: Cardiff 7679.

New Phone No.—The telephone number of the auxiliary office of BABCOCK AND WILCOX, LTD., at Audrey House, Houndsditch, E.C.3, has been altered to Avenue 7171.

Representative.—Electropower Gears, Ltd., have appointed Warton Mitchell, Ltd., 16-18 Russell St., Manchester 1, as their sole representative for Northern Counties.

Sulphuric Acid.—The Board of Trade has made an order, with effect from April, increasing the maximum price of weak sulphuric acid by 11s. 6d. per ton, and strong acid by 14s. 6d. per ton.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Auto Electrical Service Co. (Reading), Ltd.—Meeting of creditors at Oddfellows Hall, 171 Friar Street, Reading, on April 19, at 4 p.m.

Southern Electrical Accessories, Ltd.—General meeting of members to receive liquidators account of voluntary winding-up at 21 Cumberland Place, Southampton, on May 2, at 11.30 a.m.

The Ideal Electrical and General Engineering Co., Ltd.—Resolution for voluntary winding up passed at meeting on Mar. 24. Mr. R. Beevers, 49 and 50 Bradford St., Walsall, appointed liquidator.

First Meeting

High Court of Justice.—R. H. Boyland and Co., Ltd., 153 Seymour Place, W.1. Creditors' and contributories' meetings at 2.30 p.m. and 3 p.m. respectively on April 12 at 4th Floor, Columbia House, Aldwych, W.C.2.

Payment to Preferential Creditors

High Court of Justice.—Mallinson and Partridge, Ltd., 89 Hervey Close, N.3. Intended payment to preferential creditors. Last day for receiving proofs, April 15. Liquidator, J. M. Clarke, Official Receiver and Liquidator, Columbia House, Aldwych, W.C.2.

BANKRUPTCY ACTS

Intended Dividend

Chelmsford.—J. W. Watson, 154 Aldborough Road, Seven Kings, Essex. Supplemental payment of 1s. 4½d. per £ payable on April 7, at Official Receiver's Office, 3 Central Buildings, Matthew Parker Street, S.W.1.

BUSINESS PROSPECTS

HOME

Ashbourne R.D.C. Erection of 24 houses. Surveyor, H. Litchfield, Compton Offices, Ashbourne.

Bootle T.C. Erection of 24 dwellings on site near Ford Station. Borough Surveyor, Town Hall, Bootle.

Bristol T.C. Erection of 31 four-storey flats at Great Ann Street, Bristol 2. City Architect's Department, New Council House, College Green, Bristol, 1.

Bromley T.C. Erection of 40 flats and 36 maisonettes at Blyth Road, Bromley. Borough Engineer, Municipal Offices, Bromley.

Carlton U.D.C. Erection of 20 flats at Cavendish Road/Alpine Crescent housing site. J. R. Campbell, Engineer and Surveyor, Council House, Burton Road, Carlton.

Cornwall C.C. Erection of an automobile workshop at Cornwall Technical College, Dolcoath, Camborne. Sydney Gregson, County Architect, County Hall, Truro.

Cosford R.D.C. Erection of 8 houses at Swan Street. Architect, E. Fincham, 9 Palmers Avenue, Grays, Essex.

Dewsbury T.C. Erection of 12 bungalows at Lee housing estate. Borough Architect and Buildings Surveyor, Town Hall, Dewsbury.

Durham C.C. To carry out extensions (in hutments) at the following schools: Dawdon County, Hebburn Quay County Infants', Jarrow Grammar, Middleton St. George County, Murton County Infants' Murton County Junior Mixed, Spennymoor County King Street Infants', Usworth Modern, Washington Grammar, and West Cornforth County Infants. County Architect, Court Lane, Durham.

Durham Education Committee. Electrical installation work costing £475 to be carried out at Sacriston County School. County Architect, County Hall, Durham.

East Suffolk C.C. Adaptation of "Egremont," Southwold, into children's home, and Kirkley Hotel, Lowestoft, into home for aged people. E. J. Symcox, County Architect, County Hall, Ipswich.

Filey U.D.C. Erection of 23 houses on Muston Road site. Architect, F. Vaux, 31 Quay Road, Bridlington, Yorks.

Folkestone T.C. Erection of 32 houses (Contract Nos. 2, 3, and 4) at Biggins Wood. Borough Engineer, Municipal Offices, West Terrace, Folkestone.

Hebburn-on-Tyne U.D.C. Erection of 56 houses on Hartleyburn housing site. Architects, Page Son and Hill, 73 King Street, South Shields.

Hendon T.C. Erection of 44 flats at Abercorn Road, Mill Hill. Borough Engineer and Surveyor, Town Hall, Hendon, N.W.4.

Hepton R.D.C. Construction of 28 houses at Wadsworth housing estate. Architect, N. H. Singer, District Bank Chambers, Hebden Bridge.

Ilkeston T.C. Erection of 116 houses for first section of Kirk Hallam housing estate. Quantity Surveyors, Gleeds, 21 Victoria Street, Nottingham.

Lancs. C.C. Erection of primary schools at Lancaster, The Marsh; Ashton-under-Lyme, Broad Oak; Chadderton, Yewtree; Clitheroe, Low Moor; Worsley, Mesne Lea; Crosby (Liverpool), College Road; Failsworthy, Holt Lane. G. Noel Hill, County Architect, County Offices, Preston.

Lexden and Winstree R.D.C. Erection of 2 blocks of four terrace houses at Stanway. Duncan Clark and Beckett, Architects, 7 West Stockwell Street, Colchester.

Middlesbrough T.C. Erection of 54 houses at Saltersgill. Borough Engineer and Surveyor, Municipal Buildings, Middlesbrough.

Middlesex C.C. County Architect to arrange for improvement of electric lighting installations at Willesden, Dudden Hill school (estimated cost £3,200) and Leopold Road school (estimated cost £3,150).

Newcastle-on-Tyne T.C. Three more hostels for old people are to be provided. City Architect, G. Kenyon, 18 Cloth Market, Newcastle-on-Tyne.

Portsmouth T.C. Erection of Paulsgrove Modern School for Girls. (Stage 2.) City Architect, City Council Chambers, 1 Clarence Parade, Southsea.

Rotherham R.D.C. Erection of 30 houses at Thrybergh. Council's Architects, Taylor, Knight and Co., All Saints' Square, Rotherham.

Sheffield T.C. Erection of a youth employment centre at West Street. Town Clerk, Town Hall, Sheffield 1.

Southwell R.D.C. Erection of 26 houses at Broomfield Lane, Farnsfield. Surveyor, S. Cooper, 8 Westgate, Southwell.

Southwick U.D.C. Erection of 30 houses at Ridgeway extension housing estate. Engineer and Surveyor, Town Hall, Southwick.

Stratford-upon-Avon T.C. Erection of 19 houses at Redlands estate, Alcester Road. Borough Engineer, Municipal Offices, Stratford-upon-Avon.

Sunderland T.C. Repairs and alterations to Fulwell fire station. Borough Architect, H. C. Bishop.

Tenby T.C. Erection of 22 houses at the Glebe estate, Tenby. W. D. Waine, Borough Surveyor, Civic Centre, Tenby.

West Riding C.C. All trades in work for adaptation of "Woodville," Spring Gardens, Keighley, as residential accommodation for aged persons. County Architect, County Hall, Wakefield.

OVERSEAS

Chile. Senor Jorge Beier, Messrs. Jose Chibbaro (Salmeri) Ahumada 312, Of. 306, Santiago. Interested in negotiating for exclusive agency agreements with U.K. manufacturers of electric wheel barrows, ovens, measuring instruments, and motors.

Persia. Information on electrical equipment required by Persian Seven Year Plan Organisation, Bank Sanati, Teheran. Mr. Houshang Nayar-Nuri, manager of the organisation's electricity department requires literature describing power and distribution equipment which U.K. firms can offer. Particularly interested in transformers 100-3,000 kVA.

Wellington, N.Z. Tenders have been invited for two additional 15,000 kW turbine and generator units for Waitaki h.e. station in the South Island. Units will be similar to those already installed, and will come from Britain.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Globelite. B677,460. Class 9. Electric storage batteries. Globelite Batteries, Ltd., 146 Alexander Ave., Winnipeg, Manitoba.

Festival. 684,584. Electrical, scientific and nautical apparatus and instruments, and radio receiving sets (complete). E. K. Cole Ltd., Ekco Works, Priory Crescent, Southend-on-Sea.

Minerva, with design. 671,251. Class 9. Sound reproducing appearance for use in connection with cinematographic films. Jay Scientific Instruments, 237 Westfield Lane, Wyke, Bradford.

Novaglow. B682,317. Class 9. Electrically illuminated signs. Nova Sign Co., 2 Saville Place, Newcastle-on-Tyne 1.

Prefect. 685,324. Class 9. Wireless and television aerials, and masts and supports. Kennedy and Owen, 9 Earlsdon St., Coventry.

Prento. 683,178. Class 9. Electrical apparatus and parts. Prentice Ltd., Progress Works, Gelderd Rd., Leeds 12.

Stal. 660,296. Class 7. Turbine-driven electrical generators, steam tubines, grinding machines, and boring and grinding machines. Svenska Turbinfabriks, Aktilbolaget Ljungstrom, Slottsvagen 1, Slottet 1, Finspong, Sweden.

Uncle Holly. 683,832. Class 9. Electrical, wireless, photographic and cinematographic apparatus and instruments. Selfridges Ltd., 400 Oxford St., London, W.1.

MEETINGS TO NOTE

THURSDAY, APRIL 6

I.E.E. (Bristol students).—"Some Types of Microphones," R. J. Galton, Electricity Showroom, Bath.—7 p.m.

WEDNESDAY, APRIL 12

I.E.S. (Swansea group).—"Lighting of Steelworks," J. D. Callaway, Y.M.C.A., Swansea.—6 p.m.

I.E.E. (Radio section).—"A Review of some T.V. pick-up tubes," J. D. McGee. "The Design of a T.V. Camera Channel for Use With the C.P.S. Emitron," E. L. C. White and M. G. Harker. Institution, Savoy Place, W.C.2.—5.30 p.m.

I.E.E. (Scottish centre).—Informal discussion. "Some Experiments in Pulse Methods of Fault Location on Overhead Lines," D. W. Berry. Heriot-Watt College, Edinburgh.—7 p.m.

I.E.E. (Southern centre).—"The Continental Development of Single-Anode Mercury Arc Rectifier Valves of High Power," H. von Bertele. Technical College, Brighton.—6.30 p.m.

I.E.E. (S. Midland students).—Radar Evening; films, talk, D. H. Webber. James Watt Institute, Birmingham.—6.30 p.m.

A.S.E.E. (Bradford branch).—"The Three Phase Induction Motor and its Application," by G. Briggs. Midland Hotel, Bradford.—7.30 p.m.

A.S.E.E. (Coventry branch).—"Electrical Installations," J. Flood. Technical College, The Butts, Coventry.—7 p.m.

THURSDAY, APRIL 13

I.E.S. (Cardiff centre).—"Lighting of Steelworks," J. D. Callaway. S. Wales Electricity Board demonstration theatre, The Hayes, Cardiff.—5.45 p.m.

I.E.E. (Utilisation section).—Discussion. "B.S.I. Specifications in relation to Electrical Accessories for Domestic and Industrial Applications," J. F. Stanley. Institution, Savoy Place, W.C.2.

E.P.E.A. (N. Meter and Instruments (Technical) group).—Annual General Meeting. "A simple outline of the factors influencing the stable operation of an electrical power system," A. H. Grey and D. R. Fenwick. Engineers' Club, Albert Square, Manchester.—6.30 p.m.

I.E.E. (Rugby students).—"Railway Signalling," R. Buglar. E.M.E.B. Showrooms, Rugby.—6.30 p.m.

FRIDAY, APRIL 14

JNR. INSTN. ENGRS. (Ordinary meeting).—"The Induction Motor, with particular reference to single phase machines and some account of their development," R. J. Herbert. 39 Victoria Street, S.W.1.—6.30 p.m.

I.E.E. (N.E. students).—"Calculating Machines," C. G. Hopper. Grey Hall, King's College, Newcastle-on-Tyne.—7 p.m.

SATURDAY, APRIL 15

I.E.E. (N. Midland students).—"Surge Phenomena in Power Engineering," A. W. Greenwood. Yorkshire Board Officer, Ferensway, Hull.—2.30 p.m.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons, Ltd., 116 Chancery Lane, London W.C.2.

Dowson, Hird and Edkins Ltd. To take over business of electrical and radio engineer carried on at 40 Market Place, Bishop Auckland by Wm. Dowson. Cap.: £3,000. Dirs.: Mrs. R. P. Hird, W. F. Hird, G. G. Edkins.

Electrodac Ltd., 19 Gt. Winchester Street, E.C.2. Manufacturers of and dealers in electrical and other equipment and appliances, etc. Cap.: £2,000. Dirs.: D. A. Crow, Helen C. Crow, C. J. H. Davidson.

Electrical Contractors (Coalville) Ltd. Cap.: £1,000. Subs.: J. R. Hardy, K. A. Fox.

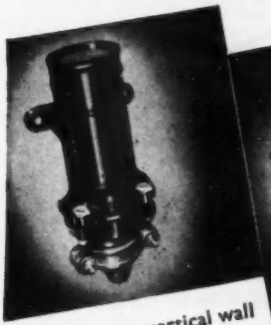
Harris's Electrical Services (Tipton) Ltd., 87 Reddal Hill Road, Old Hill, Staffs. Cap.: £2,000. Dirs.: H. Harris, S. Paul.

Northdown Industries (London) Ltd. To carry on business of general, constructional, mechanical and electrical engineers, etc. Cap.: £1,000. Subs.: H. F. Minto, C. W. Hampton.

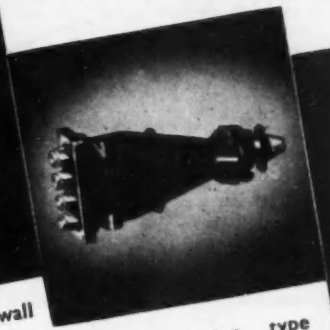
Penge Electric Ltd., 13a High Street, Penge, S.E.20. Manufacturers of and dealers in electrical and other equipment, etc. Cap.: £1,500. Dirs.: S. G. Burdick, E. R. Mearns.

T. E. P. Stores (Darlington) Ltd., 38 Coniscliffe Road, Darlington. Wholesale electrical goods factors and dealers, etc. Cap.: £5,000. Dirs.: D. S. Thompson, Mrs. I. A. Thompson.

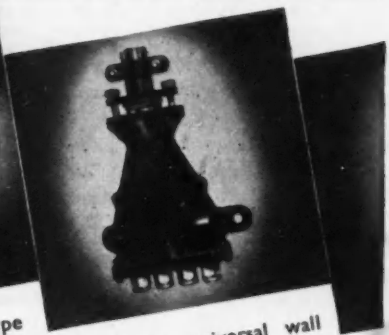
Brush (Far East), Ltd., has been formed with registered offices at Ocean Buildings, Singapore, to be factory representatives of Petter, Petter-Fielding, McLaren, Mirrlees, National and Meadows diesel engines and of the products of Bryce Fuel Injection, Ltd., and the Brush Electrical Engineering Co., Ltd., in Malaya, Indonesia, French Indo-China, Borneo, Sarawak, Siam, Philippines, China, Hongkong, Japan, Formosa and Ceylon. Mr. H. F. Clements is chairman and the Hon. A. C. Geddes, Mr. F. A. Faughan, Mr. A. A. King are directors. The individual companies will, however, continue to sell their products through their existing agents.



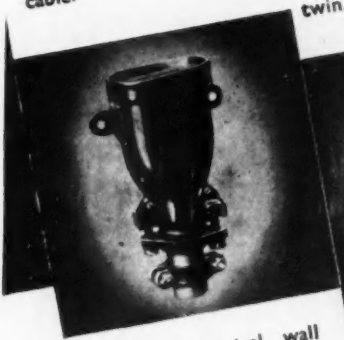
Circular type, vertical wall mounting, for single core cable.



Flange mounting type (horizontal or inverted) for twin, 3 and 4-core cables.



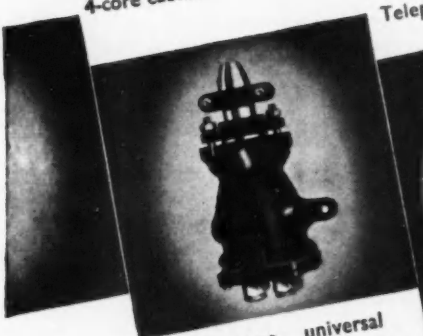
Flat type, universal wall mounting, for twin, 3 and 4-core cables.



Flat type, vertical wall mounting for twin, 3 and 4-core cables.

Circular type, vertical wall mounting, for 3 and 4-core cables, and Signal, Pilot or Telephone Cables.

Flange mounting type (vertical) for twin, 3 and 4-core cables.



Circular type, universal wall mounting, for 3 and 4-core cables.

There's a HENLEY Indoor Terminal Box to suit every normal requirement, for working pressures up to 660 V. Please write for Catalogue 35.

HENLEY

TERMINAL BOXES

W. T. Henley's Telegraph Works Co. Ltd., 51/53 Hatton Garden, London, E.C.1.

NEW

developments

As an addition to the 5 ft. Mellow lamp introduced on January 1st, now comes the 4 ft. MELLOW Lamp.
Price: 14/- each plus 3/8 purchase tax (standard)
Price: 15/- each plus 3/11 purchase tax (instant start).

COLOURED FLUORESCENT LAMPS in red, yellow, green, blue
Price: 20/- each plus 5/3 purchase tax (standard)
Price: 21/- each plus 5/8 purchase tax (instant start).

METROPAL lamps, 200/260 v. 100 watt Coiled-Coil.
This new lamp has all the pleasing external appearance of an opal lamp but with an efficiency approaching that of the Pearl lamp. The diffused light effect is obtained by coating the inside surface of the bulb with a silica compound.
Price 2/- each plus 7d. purchase tax.

METROVICK LAMPS

METROPOLITAN-VICKERS ELECTRICAL CO. LTD., ST. PAUL'S CORNER
1-3 ST. PAUL'S CHURCHYARD, LONDON E.C.4

S/A006

CLASSIFIED ADVERTISEMENTS

OFFICIAL TENDERS AND APPOINTMENTS

WANTED · FOR SALE WORK WANTED

Those wishing to advertise in these pages should send the text to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia St., W.C.2, before 10 a.m. on TUESDAY of week of issue. Official Displayed Advertisements are charged at 35s. per inch, and all other classified advertisements at 2s. 6d. per line. Situations Wanted will be published four times for twice the single insertion rate. Fee for Box No. and postage on replies is 2s.

TENDERS INVITED

CITY OF MANCHESTER EDUCATION COMMITTEE

Extension to the Municipal College of Technology

ELECTRICAL ENGINEERING EQUIPMENT

TENDERS are invited for the following:—

Oscillographic Equipment, comprising 9 cathode-ray oscilloscopes, amplifier units, and 1 recording camera. Reference No. 246.

Laboratory Instruments, comprising 2 valve voltmeters, 15 portable sub-standard instruments, and 10 first-grade instruments. Reference No. 247.

Six Audio-frequency Oscillators. Reference No. 252.

Relays and Associated Equipment for demonstration protective systems. Reference No. 259.

Tenderers should be familiar with the provisions of Standing Order 76 (a and b) of the Manchester City Council, a copy of which, together with more detailed specifications regarding the above items, may be obtained from the Principal, College of Technology, Manchester 1.

Tenders (in duplicate), in sealed envelopes endorsed "College of Technology, Electrical Equipment," should be addressed to the Chairman, College of Technology, Sub-Committee, Education Offices, Deansgate, Manchester 3, so as to reach him not later than 10 a.m. on Saturday, April 15, 1950.

The Committee do not bind themselves to accept the lowest or any tender. (E 312)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

33 kV OVERHEAD LINES

TENDERS are invited for the supply, delivery and erection of approximately 8½ miles of 33 kV single circuit wood pole overhead lines in the neighbourhood of Killin, Perthshire.

Copies of the Tender Document may be obtained on and after Thursday, April 6, 1950 on application to the Engineers, Messrs. Merz and McLellan, 39 Northumberland Street, Edinburgh 3. Applications should be accompanied by a cheque for £1 1s. which will be returned on receipt of a bona fide tender.

Tenders in duplicate enclosed in a sealed cover and endorsed on the left hand corner "Contract C/18/LW/10" must reach the subscriber not later than Monday, May 1, 1950.

The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.

16 Rothesay Terrace, Edinburgh 3.
March 31, 1950. (E 339)

BOROUGH OF REIGATE

ELECTRICAL REWIRING OF TOWN HALL

TENDERS are invited from electrical contractors who are accustomed to exterior conduit work in public buildings.

Form of tender, specification, general conditions and plan may be obtained from Mr. G. G. Sanderson, A.M.I.C.E., M.I.Mun.E., Borough Surveyor, Town Hall, Reigate, upon deposit of £2. This sum will be returned upon receipt of a bona-fide tender (which is not subsequently withdrawn) and the return of all documents. Cheques to be made payable to Reigate Corporation.

Tenders in plain sealed envelopes, bearing no mark or indication of the sender, and endorsed "Rewiring for Town Hall" must be received by me not later than Friday, 28 April, 1950.

The Council does not bind itself to accept the lowest or any tender.

HEBER DAVIES,
Town Clerk.

Town Hall, Reigate, Surrey.
March 29, 1950 (E 325)

APPOINTMENTS VACANT

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of THIRD ASSISTANT ENGINEER (Planning) in the Technical Department at Divisional Headquarters, Liverpool.

Applicants should possess an engineering degree or equivalent qualifications and preferably have some knowledge of short-circuit and load flow calculations. Experience in circuit and diagram work would be an advantage.

The salary will be in accordance with Class "AX," Grade 5 of the Revised National Joint Board Schedule, i.e., £579-£710 per annum.

The appointment will be superannuable under the British Electricity Authority and Area Board's Superannuation Scheme and is subject to a medical examination.

Forms of application can be obtained from the Divisional Secretary, British Electricity Authority, Merseyside and North Wales Division, Clarke Gardens, Woolton, Liverpool, and should be returned to him to be received not later than Friday, April 21, 1950.

A. R. COOPER,
Divisional Controller.
(E 338)

NORTH THAMES GAS BOARD

SHIFT CONTROL ROOM ELECTRICAL ENGINEERS

APPLICATIONS are invited for the above positions at the Board's Works at Beckton, London, E.6, from men with experience in electrical control room operation, preferably holding the Higher National Certificate in Electrical Engineering.

The duties consist of the supervision of the distribution on the works of 6.6 and 22 kV supplies, keeping records and issue of "permits to work."

Starting salary £420, rising to £480 per annum. The appointments would be of a permanent nature, and pension arrangements will be discussed with short list candidates.

Applications, stating age, qualifications and experience, should be sent to the Staff Controller, North Thames Gas Board, 30 Kensington Church Street, London W.8, quoting reference number 9745, to reach him not later than April 24 1950. (E 335)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

CHEMIST—NORTHAMPTON

APPLICATIONS are invited for the appointment of Chemist at the above generating station. The salary will be in accordance with the revised National Joint Board Schedule, Class "F," Grade 8, commencing at £565 per annum.

Candidates should have had a good experience in modern power station laboratory work, covering analysis of fuel, water, and oil, be thoroughly conversant with water softening and treatment, and have some knowledge of problems relating to corrosion and boiler fouling.

Conditions of service will be governed by the revised National Joint Board Agreement.

The post will be superannuable under the British Electricity Authority's Superannuation Scheme.

Forms of application may be obtained from the Divisional Establishments Officer at the undermentioned address, and should be returned to him not later than April 17, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity House,
Barker Gate, Nottingham.
23.3.50. (E 274)

CORPORATION OF THE CITY OF GLASGOW OFFICE OF PUBLIC WORKS

Central Electrical Workshops Section

ASSISTANT SUPERINTENDENT

APPLICATIONS are invited for the appointment of an Assistant Superintendent in the Central Electrical Workshops Section of the Office of Public Works, at a salary, fixed meantime at £700 per annum pending reorganisation, when a suitable salary scale will be awarded.

Candidates must be under 45 years of age, hold an associate membership of the Institute of Electrical Engineers and have had extensive experience in designing, planning and supervising all electrical engineering services required for schools, halls, police offices, libraries, large public buildings and Corporation undertakings (e.g., cleansing, sewage, etc.).

The successful candidate will be required to assist the Superintendent in the design, control, and supervision of electrical installation work undertaken by the Corporation, either by direct labour or by contract, and in the maintenance of such installations.

The appointment will be permanent and subject to the provisions of the Glasgow Corporation Superannuation Scheme. The selected candidate will be required to undergo a medical examination.

Applications, giving full details of education, training, qualifications, experience, age, past and present appointments, together with the names of two referees, should be forwarded not later than May 1, 1950, to the subscriber.

WILLIAM KERR,
Town Clerk.

Town Clerk's Office,
City Chambers, Glasgow C.1.
April 1, 1950. (E 336)

NORTH WESTERN ELECTRICITY BOARD

No. 5 Sub-Area

ASSISTANT TO SECTION HEAD, SUB-AREA CONSUMERS' ENGINEER'S DEPARTMENT, COMMERCIAL AND DEVELOPMENT SECTION

APPLICATIONS are invited for the position of an Assistant to the Section Head (Domestic and Commercial Development) in the Sub-Area Consumers' Engineer's Department at No. 5 Sub-Area Headquarters, Jubilee Street, Blackburn.

Applicants should have experience in each of the following:—

Supervision of showrooms.
Domestic and commercial load development.
Organisation of exhibitions and demonstrations.
Publicity, advertising, and display.
Agricultural and horticultural applications.

The provisional salary for the post will be in accordance with the revised N.J.B. Schedule, Class "H," Grade 13, i.e., £458-£467-£476 per annum. The post is superannuable.

Applications, stating age, education, and training, qualifications and experience, present position and salary, should be received by R. H. Harral, Esq., M.I.E.E., M.Inst.F., Sub-Area Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, not later than Saturday, April 22, 1950. (E 306)

NORTH EASTERN ELECTRICITY BOARD

Harrogate Sub-Area

APPOINTMENT OF DEMONSTRATOR, ASSISTANT DEMONSTRATOR, AND TRAINEE DEMONSTRATOR

APPLICATIONS are invited for the above appointments, in various parts of the Harrogate Sub-Area.—Further particulars of the appointments may be obtained from the Manager, North Eastern Electricity Board, Harrogate Sub-Area, 18 King's Road, Harrogate. (E 304)

NORTH WESTERN ELECTRICITY BOARD

Area Board Headquarters

APPOINTMENT OF AGRICULTURAL DEVELOPMENT ASSISTANT

CHIEF COMMERCIAL OFFICER'S DEPARTMENT

APPLICATIONS are invited for the appointment of Agricultural Development Assistant to operate from the Board's Headquarters in Manchester.

Applications should have a wide knowledge of the applications of electricity in agriculture and horticulture and should be qualified to give lectures to meetings of farmers, growers, etc.

The salary offered is £750 per annum and is provisional and subject to negotiation pending the adoption of national scales.

Applications, stating age, technical qualifications, training, experience, present position and salary, should be received by the Establishment Officer, The North Western Electricity Board, Cheetwood Road, Manchester 8, not later than Saturday, April 29, 1950. (E 334)

LONDONDERRY CORPORATION ELECTRICITY DEPARTMENT

POWER STATION SUPERINTENDENT

APPLICATIONS are invited for the above appointment. The successful applicant will be required to take up duty on or before June 1, 1950. Salary will be in accordance with the N.J.B. Schedule, Grade 3, Class F, at present £687 to £715 per annum. A house, free of rent, rates and taxes will be available from July 1, 1950.

Superannuation will be governed by any Act to be passed in Northern Ireland. Applicants are informed that a Superannuation Bill is at present before Parliament.

Applicants must have served an engineering apprenticeship, and have both practical and technical experience in the operation, maintenance and administration of a generating station with turbo alternators, water tube boilers, and all ancillaries, and should preferably be corporate members of one of the senior engineering institutes.

Preference will be given to ex-Service applicants possessing the required qualifications, provided the Council is satisfied that such applicants can, or within a reasonable time will be able to, fill the vacant post efficiently. Applicants must not be over the age of 35 years, except in the case of War ex-Servicemen, who must not be over 40 years of age.

The successful applicant will require to pass a medical test as to fitness, etc., and to produce a certificate of birth, and will be required to comply with the provisions of the Safeguarding of Employment Act (Northern Ireland), 1948.

Applications, stating age, qualifications and experience, and present position, and marked "Power Station Superintendent," should be lodged with the undersigned not later than April 21, 1950.

Canvassing in any form will be a disqualification.

Dated this 27th day of March, 1950.

JAMES THOMPSON,
Town Clerk.

Guildhall, Londonderry. (E 333)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER
NORTHAMPTON

APPLICATIONS are invited for the appointment of Assistant Shift Charge Engineer at the above generating station.

Candidates should have had a sound general and technical education, and should be experienced in the operation of modern steam power stations.

Conditions of service will be in accordance with the revised National Joint Board Agreement, the scale being Grade 9, Class "F," commencing at £538 per annum.

The post will be superannuable under the British Electricity Authority's Superannuation Scheme.

Forms of application may be obtained from the Divisional Establishments Officer at the under-mentioned address, and should be returned to him not later than April 17, 1950.

W. S. BURGE,
Divisional Controller.

British Electricity House,
Barker Gate, Nottingham.
23.3.50. (E 273)

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

GROUP CHEMIST

APPLICATIONS are invited for the position of Group Chemist in the Generation (Operation) Department.

Applicants, who must not be more than 45 years of age (unless already in the service of the B.E.A.), should hold a university degree in chemistry and/or be a corporate member of the Royal Institute of Chemistry, must have had a considerable experience in the analysis and behaviour of fuels, oils, and waters, associated with high-pressure and high-temperature steam generating plant and turbines, and knowledge and experience in recent research and practice associated with corrosion and bonded deposits, metallurgy and metallography relating to metals and alloys used for high-temperature steam plant.

The person appointed will be located at Staythorpe Generating Station, near Newark, and in addition to Staythorpe, will be responsible for the supervision of the laboratory personnel at the other stations in the Northern Group of the Division.

Salary will be £707 per annum, which is to be regarded as provisional until the final scales have been negotiated with the appropriate organisations. The successful candidate will be required to pass a medical examination and superannuation will be under terms and conditions approved by the British Electricity Authority.

Applications should be submitted on the appropriate application form, which may be obtained from the Divisional Establishments Officer, British Electricity House, Barker Gate, Nottingham, and should be returned not later than April 24, 1950.

W. S. BURGE,
Divisional Controller.

30.3.50. (E 323)

MUNICIPALITY OF SINGAPORE

Electricity Department

APPOINTMENT OF CHARGE ENGINEER

1. The Municipal Commissioners of the town of Singapore invite applications for appointment of a Charge Engineer for shift duties at their power station. The present installed capacity is 37,000 kW, but extensions are in hand to increase this capacity to 87,000 kW.

2. Applicants must possess a thorough experience of extra high tension three phase generation, steam turbine and high pressure water tube boilers in a modern power station. Practical experience in a high pressure steam power station is essential.

3. The post is on the permanent staff of the electricity department and is in Class III of the senior officers' salary scheme with a salary range of $440 by A$30 to $590—$630 by A$30 to $750 qualification bar $790 by A$40 to $870. The commencing salary in this scale will be fixed according to the qualifications and experience of the successful candidate. Current cost of living allowance will be payable and the present rates for officers resident in Singapore are as follows: 60 per cent. on the first $200 a month of basic salary plus (i) single officers 20 per cent. on the next $500 a month of basic salary; (ii) Married officers with no dependent children 35 per cent. on the next $500 a month of basic salary; (iii) Married officers with one or more dependent children 55 per cent. on the next $500 a month of basic salary, subject to the following maximum: (i) $220 a month; (ii) $295 a month, and (iii) $395 a month.

4. Expatriation allowance where applicable is payable at the following rates: Monthly basic salary from $420 up to $599—$110 a month; monthly basic salary from $600 up to $750—$150 a month; monthly basic salary from $751 up to $870—$170 a month.

5. The exchange value of the Straits dollar is 2s. 4d. sterling. The minimum commencing salary offered to a single man is therefore £1,005 per annum, with increases if married.

6. Basic salary, expatriation allowance and cost of living allowance are subject to local taxation.

7. Partly-furnished quarters will be provided, if available, at a charge of 8 per cent. of the officer's salary. If quarters are not available, a housing allowance is payable. The present rate is 12 per cent. of basic salary, maximum $120 per month.

8. The candidate selected would be appointed on a 3 years' agreement and would be required to pass a medical examination and to join the Municipal Provident Fund under the present rules of which he must contribute 7½ per cent. of his salary and expatriation allowance. On completion of the agreement and subject to satisfactory service, the officer would normally be appointed to the permanent establishment. Leave, with full salary, at the rate of 2 months for each year of resident service, is normally granted after four years' service.

9. A free passage will be provided for the officer and, if married, for his wife and children under 17 years of age (up to a maximum of 3 full passages) together with half salary on the way out to Singapore.

10. Applications, stating age, whether married or single, birth place, details of education, qualifications, training and experience, accompanied by copies of three recent testimonials must be lodged (in duplicate) with Messrs. Peirce & Williams, No. 1 Victoria Street, Westminster, London S.W.1 (agents to the Municipal Commissioners) not later than Monday, April 17, 1950.

11. Further information, if desired, can be obtained from the agents or the Municipal Electrical Engineer, Singapore. (E 297)

BRITISH ELECTRICITY AUTHORITY

Merseyside and North Wales Division

APPLICATIONS are invited for the appointment of five STATION SHIFT CONTROL ENGINEERS for shift duties at the new Bromborough Power Station, near Birkenhead.

Applicants must have had experience in the control room of a modern power station and possess the Higher National Certificate in Electrical Engineering, or equivalent qualifications.

The salary will be in accordance with the Revised National Joint Board Schedule, the appointment being in Class "H," Grade 10, i.e., £571 per annum, rising to £597 per annum.

The appointments will be superannuable under the British Electricity Authority and Area Boards Superannuation Scheme, and also subject to a satisfactory medical examination.

Forms of application may be obtained from the Divisional Secretary, British Electricity Authority, Merseyside and N. Wales Division, British Electricity House, Clarke Gardens, Wooiton, Liverpool, and should be returned to him in a sealed envelope, endorsed in the top left-hand corner "Station Shift Control Engineer," so as to be received not later than Monday, April 24, 1950.

A. R. COOPER,
Divisional Controller.
(E 337)

NORTH WESTERN ELECTRICITY BOARD

No. 5 Sub-Area

APPOINTMENT OF ASSISTANT TO DISTRICT CONSUMERS' ENGINEER

APPLICATIONS are invited for the appointment of Assistant to District Consumers' Engineer in the Blackburn District of the No. 5 Sub-Area.

The duties of the post will be to assist in all activities normally associated with the work carried out by the Board on consumers' premises and, in addition, to supervise contract wiring, repairs, consumers' emergency service, installation of appliances, etc.

Applicants should be experienced in the negotiation of all classes of sales and load development, lecturing, exhibition and demonstration work, consumers' records systems, and supervision of staff.

The salary, which is provisional and subject to negotiations by the appropriate body, will be in accordance with the revised National Joint Board Schedule, Class "F," Grade 10, i.e., £510-£520-£530 per annum. The post is superannuable.

Applications, stating age, qualifications and experience, present post and salary, should be received by R. H. Harral, Esq., M.I.E.E., M.Inst.F., Sub-Area Manager, No. 5 Sub-Area, North Western Electricity Board, Jubilee Street, Blackburn, not later than April 22, 1950.
(E 305)

YORKSHIRE ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

No. 3 (Sheffield) Sub-Area

MAINS ASSISTANT (ROTHERHAM DISTRICT)
Vacancy No. 15/50

Applicants should have had a good general and technical education, with training and experience in an engineering workshop or in the electricity supply industry. The person appointed will be stationed at Mexborough.

Provisional salary in accordance with the National Joint Board Schedule, Class "J," Grade 9a, £423-£443 per annum, subject to negotiations with the appropriate organisations.

Applications, stating the above vacancy number, giving age and full details of qualifications and experience, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, within 14 days of the appearance of this advertisement.

No. 4 (Leeds) Sub-Area

OPERATION ASSISTANT
Vacancy No. 15/50

The successful applicant will be responsible to the Assistant Operation Engineer and will be required to carry out switching operations and the making of apparatus safe to work on during his shift. Applicants should have experience in switching operations on high-voltage distribution systems incorporating cubicle type and metal-clad switchgear.

Provisional salary in accordance with the National Joint Board Schedule, Class "L," Grade 10a, £415-£434 per annum, subject to negotiations with the appropriate organisations.

Applications, stating the above vacancy number, giving age and full details of experience and qualifications, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, 1 Whitehall Road, Leeds, within 14 days of the appearance of this advertisement.

No. 5 (Wakefield) Sub-Area

DRAUGHTSMAN, GRADE II
(CASTLEFORD DISTRICT)
Vacancy No. 21/50

Applicants should have a knowledge of the theory and principles of design, layout, and construction of modern civil, mechanical, and electrical plant, and should be experienced in instrumental surveys of such schemes. They must also be fully conversant with modern methods of compiling accurate records of distribution and substation plant alterations and extensions.

Provisional salary £360 by £20 to £400 per annum, subject to negotiations with the appropriate organisations.

DRAUGHTSMAN, GRADE III
(CASTLEFORD DISTRICT)
Vacancy No. 21/50

Applicants must be able to undertake general draughtsmanship work under supervision, including the recording of mains extensions and alterations.

Provisional salary, £290 by £20 to £350 per annum, subject to negotiations with the appropriate organisations.

Applications, stating the above vacancy numbers, giving age and full details of education, qualifications, and experience, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Road, Wakefield, within 14 days of the appearance of this advertisement. (E 324)

SOUTH EAST SCOTLAND ELECTRICITY BOARD

Edinburgh Sub-Area

APPLICATIONS are invited for two FIRST ASSISTANT DISTRICT ENGINEERS, Grade F.5, salary £711, rising to £737 per annum, to assist in the operation and maintenance of the distribution system.

The supply area is the City of Edinburgh, a densely loaded urban area of 56 square miles. Transmission is at present at 33 kV and 6·6 kV from Portobello Power Station by underground cables, and the final low-tension distribution system is at 400/230 V alternating current.

There are seven rotary sub-stations supplying direct current to the tramways and to the remnants of a d.c. distribution system that is in process of changeover. All mains and sub-station extensions are carried out by direct labour.

Preference will be given to applicants who have sound technical qualifications and suitable previous experience. Energy and initiative are essential. Good opportunities for promotion are open to men who can make an outstanding success of the respective posts.

The positions are superannuable and successful applicants will be required to pass a medical examination.

Applications, in writing, stating age, education, qualifications, experience, present employment, should be received by the undersigned within 14 days after the appearance of this advertisement.

G. T. ALLCOCK,
Manager.

Edinburgh Sub-Area,
S.E. Scotland Electricity Board,
Dewar Place, Edinburgh 3.
March 27, 1950. (E 303)

SOUTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the position of DISTRICT ENGINEER in District 342 (Bedwellty, Gelligaer, Merthyr and Rhymney) in the Central Sub-Area of the Board.

Preference will be given to applicants who possess either an engineering degree of a British university, the Higher National Certificate in Electrical Engineering or its equivalent.

The salary for the position will be in accordance with Class "E," Grade 2 (£856-£876-£896) of the National Joint Board Schedule for the Electricity Supply Industry.

Applications, stating age, present position, present salary, qualifications, experience and whether married or single, together with the names and addresses of three referees, should be addressed to the Secretary (Establishments Section), South Wales Electricity Board, St. Mellons, Cardiff, so as to reach him not later than April 15, 1950. (E 295)

REGULAR COMMISSIONS IN THE CORPS OF ROYAL ELECTRICAL AND MECHANICAL ENGINEERS

APPLICATIONS are invited from qualified ELECTRICAL AND MECHANICAL ENGINEERS between the ages of 21 and 27 years for regular commissions in the Royal Electrical and Mechanical Engineers.

They must hold one of the following technical qualifications:—

(a) Have an engineering degree from a British university coupled with one and a half years' practical workshop experience as an engineering apprentice.

(b) Have passed or been exempted from Sections A and B of the Association Membership Examination of the Institution of Mechanical or Electrical Engineers coupled with two and a half years' practical workshop experience as an engineering apprentice.

Application forms, together with details of pay, allowances, and pension, can be obtained from the War Office (MS 2(c)), London S.W.1. (E 302)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following appointment :—

STATION SHIFT CONTROL ENGINEER—Little Barford Generating Station.

Salary in accordance with revised N.J.B. Schedule, Grade 10, Class " G " (£539-£561 per annum).

Applicants should have reached the standard of ordinary National Certificate in Electrical Engineering or its equivalent, have experience in the operation of a switchboard at a generating station and be fully conversant with h.t. switching operations and protecting systems.

The appointment will be superannuable in accordance with the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, stating age, experience and present position, should be sent to the Divisional Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to arrive not later than April 14, 1950. Envelopes should be endorsed " Station Shift Control Engineer," Little Barford.

W. N. C. CLINCH,
Controller.

Northmet House, Southgate, N.14. (E 270)

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following post:—STATION SUPERINTENDENT, Rye House Generating Station, Hoddesdon, Herts.

The station is now under construction and the appointment will carry the classification of Class "G," Grade 1, in accordance with the present programmed plant capacity, the commencing salary being £1,089 per annum.

The successful applicant will be responsible for the efficient local management and operation of the station. Applicants should have received a thorough technical and practical training, followed by a career giving wide experience in the operation and maintenance of generating station plant, and also must have held a position of responsibility, involving the control of technical, operating and administrative staffs. The successful applicant will be expected to reside within a reasonable travelling distance of the generating station.

The salary and conditions of service will be in accordance with the N.J.B. Agreement and the appointment will be superannuable in accordance with the British Electricity Authority and Area Boards' Superannuation Scheme.

Applications should be made on forms of application obtained from the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, N.14, to whom completed forms should be sent to arrive not later than the 21st April, 1950.

W. N. C. CLINCH,
Controller.

Northmet House, Southgate, N.14. (E 326)

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the position of BOILER-HOUSE SHIFT CHARGE ENGINEER at Earley Generating Station.

Applicants must have had a sound technical training and be experienced in all branches of engineering associated with the operation of pulverised fuel fired h.p. boiler plant, and considerable knowledge of combustion and boiler chemistry. Graduate membership of the Institution of Mechanical or Electrical Engineers will be a strong recommendation.

The salary will be in accordance with Grade 9, Class "G," of the National Joint Board Schedule, at present £571-£597 per annum.

Application forms may be obtained from the undersigned and should be returned not later than April 24, 1950.

P. D. A. OLIVER,
Divisional Secretary.

British Electricity House,
High Street, Portsmouth.
GEW BMB/30.
30.3.50. (E 342)

THE BRITISH IRON AND STEEL RESEARCH ASSOCIATION

THE following staff are required by the above Association to carry out applied research on engineering problems in the iron and steel industry:—

ONE ASSISTANT MECHANICAL ENGINEER, preferably with experience in heavy engineering.

ONE ASSISTANT FUEL TECHNOLOGIST, with experience in connection with high-temperature furnace operation.

Applicants for these two posts must possess an honours university degree and be within the age limits of 23-27. Salaries will be within the range £400-£550, according to age, qualifications and experience.

ONE TECHNICAL ASSISTANT (ELECTRICAL), preferably with experience in light electrical engineering or electronics.

ONE TECHNICAL ASSISTANT (CIVIL), preferably with the ability to undertake statistical and other mathematical computations.

ONE TECHNICAL ASSISTANT (FUEL TECHNOLOGY), preferably with experience of high-temperature furnace operation.

Applicants for posts as Technical Assistants must possess a Higher National Certificate and be within the age limits of 21-25. Salaries will be within the range £300-£400, according to age, qualifications, and experience.

Applicants for any of the preceding positions must have had an apprenticeship or practical experience and membership of the appropriate professional institution would be an advantage. An aptitude for original research or operational studies in the field or laboratory is also desirable.

Written applications only, quoting "Plant Engineering," and giving full curriculum vitae, to the Personnel Officer, B.I.S.R.A., 11 Park Lane, London W.1.
31.3.50. (E 340)

A DESIGNER/DRAUGHTSMAN required by manufacturers of "Temco" Domestic Electrical Accessories Must be familiar with the light electrical apparatus industry.—Write, giving full details of experience and salary required to Personnel Manager, Telephone Manufacturing Co., Ltd., Martell Road, West Dulwich, S.E.21. (E 247)

BOX No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London W.C.2

A C.M.A. CABLE COMPANY requires AGENT to cover Eastern Area Board.—Box No. 1111, Electrical Times. (E 237)

A TRANSFORMER DESIGN ENGINEER is required for work at Stafford with the English Electric Co. Preference will be given to a man who has had previous design experience of power transformers.—Apply, with full particulars, quoting Reference 225, to Central Personnel Services, English Electric Co., Ltd., 24/30 Gillingham Street, London S.W.1. (E 264)

APPLICATIONS are invited for the post of ASSISTANT INSPECTOR to the Ceylon Fire Insurance Association in Colombo. Applicants should have had comprehensive training in electrical engineering, embracing a five years' apprenticeship and general experience in installation work, particularly in connection with wiring for lighting and power, and possess a sound general knowledge of mechanical engineering and building construction. Candidates should be about 30 years of age, well educated, and of good address.—Applications and inquiries should be sent to the Secretary, Fire Offices' Committee (Foreign), 65 Watling Street, London E.C.4. (E 318)

AREA REPRESENTATIVES required by electrical wiring accessories manufacturers, on salary, commission and expenses. Application, stating age, experience and area covered to Box No. 1147, Electrical Times. (E 291)

ASSISTANT TO SALES MANAGER required for London office by engineering company exporting diesel engines, pumping and hydraulic machinery, etc., for market research and internal sales propaganda. Experience overseas essential. Knowledge of languages an advantage. Replies to give full details of past experience, qualifications, age and salary required.—Box No. 1163, Electrical Times. (E 311)

EKCO-ENSIGN ELECTRIC, LIMITED, are expanding their sales activities and require additional REPRESENTATIVES in the London and Home Counties for the sale of lighting equipment and lamps. The positions offer good salary, commission and expenses and are eligible for the superannuation scheme.—Written applications, with full details, to the Sales Manager, Ekco-Ensign Electric, Ltd., 5 Vigo Street, London W.1. (E 287)

ELECTRICAL DESIGNER required for the F.H.P. Motor Laboratory of a large light electrical engineering company in the West London area. Applicants should have a sound technical and practical training, with initiative to accept full responsibility of a project from the initial design stage to factory production. Excellent prospects if qualifications and experience are suitable.—Apply, giving details of age, education and job history to Box No. 1157, Electrical Times. (E 308)

ELECTRICAL ENGINEER. Degree or equivalent, required for Bahrein Petroleum Co., Ltd., with five years' minimum experience design and layout of power generator, transmission and distribution equipment and operation. Some experience of American equipment desirable. Age 26-35. Commencing salary £1,320 per annum, plus free board, air-conditioned accommodation, and medical attention. 10 per cent. separation allowance paid married employees during initial two years separation period. Low living costs. Two years' contract with paid leaves and permanency right man.—Write, giving full particulars age, qualifications, experience, etc., to Box 3374, c/o Charles Barker & Sons, Ltd., 31 Budge Row, London E.C.4. (E 229)

ELECTRICAL ENGINEER required for large factory in north-west England, experienced in high- and low-voltage distribution, power and lighting installations, automatic control equipment, and instrumentation.—Applications, stating full particulars of technical and practical training, appointments held and present salary to Box No. 1101, Electrical Times. (E 201)

ENGINEERS, aged 25/35, with Higher National Certificate and practical training in electrical engineering, are invited to apply for vacancies which exist for transformer sales and contracts engineers at the Stafford Works of the English Electric Co.—Application, giving full details and quoting Reference 396, should be sent to Central Personnel Services, English Electric Co., Ltd., 24/30 Gillingham Street, London S.W.1. (E 263)

DRAUGHTSMEN, SENIOR AND JUNIOR, for design and development, in connection with domestic and heavy-duty cooking and heating and kindred appliances. Experience in this class of draughtsmanship essential. Good wages, staff superannuation, comprehensive welfare facilities available.—Apply, Personnel Manager, Simplex Electric Co., Ltd., Oldbury. (E 253p)

FITTERS AND WINDERS experienced in large repair shop practice, wanted urgently. —Apply, in person or writing, Dowding and Mills, Ltd., Camp Hill, Bordesley, Birmingham 12. (E 344p)

ELECTRICAL ENGINEER required to deal with matters relating to the use of copper and copper alloys for electrical purposes. Candidates must be Corporate members of the Institution of Electrical Engineers and have had good practical experience, preferably including some experience of overhead lines. Commencing salary £800 per annum upwards, according to qualifications, plus superannuation. Applications, stating age, details of training and experience, should be marked "Personal" and addressed to the General Manager, Copper Development Association, Kendals Hall, Radlett, Herts. (E 331)

ENGINEER DRAUGHTSMAN with experience in design, layout and installation of complete electrical equipment for gas and chemical plants required by firm of engineers and contractors.—Apply, stating age, experience and salary required to Box No. 1145, Electrical Times. (E 290)

ESTIMATING ENGINEER installation work, must have actual experience contractor's office. Excellent prospects for good man.—Write experience (chronologically) and salary required: Alliance Electrical Co., Ltd., 2 Henrietta Street, London W.C.2. (E 265)

ESTIMATING ELECTRICAL ENGINEER, aged 25-35, required by the Morgan Crucible Co., Ltd. Must have ordinary National Certificate in Electrical Engineering and wide practical experience in electrical installations; good knowledge of a.c. and d.c. motors and control gear and be able to prepare drawings and estimates for electrical work.—Write, giving details of age, experience, qualifications and salary required to the Staff Manager, Battersea Church Road, S.W.11. (E 296)

EXPERIENCED ESTIMATING ENGINEERS required in London and Manchester, capable preparing tenders for electrical rotating plant and attendant apparatus.—Applications, stating age and salary expected to Personnel Manager, Lancashire Dynamo and Crypto, Ltd., Trafford Park. (E 282)

FERRANTI LIMITED have staff vacancies for Engineers in their Power Engineering Department as follows:

Reference T.W. Various positions in an ASSISTANT capacity in WORKS MANAGEMENT. Young men are required with practical experience and preferably academic qualifications and keen on the manufacturing side.

Reference T.M. WORKS METHODS AND PROCESS DEVELOPMENT ENGINEERS. Men are required with experience of production methods and techniques to deal with all aspects of modern power transformer manufacture.

Reference T.R. ELECTRICAL AND MECHANICAL ENGINEERS for Development and Research Work on power transformers and ancillary equipment. Men are required with academic qualifications and preferably with subsequent experience in this or a similar field.

Reference T.D. ELECTRICAL ENGINEERS for Design Work on power transformers. Men are required with academic qualifications and preferably with subsequent engineering experience.

Reference T.E. ESTIMATING ENGINEERS. Men are required with experience of, or interested in training for, estimating positions in Power Transformer Work.

Reference T.D.O. DESIGNING DRAUGHTSMEN, preferably with experience on Transformers.

Progressive salaries are paid which are generally in alignment with the Scientific Civil Service rates with allowances for ability, experience and qualifications.

The Company has a Staff Pension Scheme.

Application forms from the Staff Manager, Ferranti Limited, Hollinwood, Lancs.

Please quote reference of appropriate vacancy. (E 226)

REPRESENTATIVE required by eminent London electrical wholesalers. Connection with contractors and industrial users in N.W. London area essential.—Apply in writing to B. Finch and Co., Ltd., 238 Waterloo Road, S.E.1. (E 206)

ENGINEERS, SENIOR AND JUNIOR, for development work. Experience of domestic or industrial appliances or electro-mechanical laboratory work essential. These remunerative appointments carry good prospects, staff superannuation, welfare, sports, and social facilities.—Apply, stating full particulars, to Personnel Manager, Simplex Electric Co., Ltd., Oldbury. (E 254p)

FOREMAN PIPE FITTER/WELDER required for large factory in north-west England, conversant with the installation, maintenance, and repair of high and low-pressure pipework for steam, water, and gas, with specialised knowledge of gas and arc welding. Heating installation experience desirable.—Applications, giving full particulars of experience, appointments held, and present salary, to Box No. 1099, Electrical Times. (E 200)

FOREMAN SUPERINTENDENT required for large coil-winding shop manufacturing a big variety of coils. Applicants must be thoroughly conversant with all aspects of winding and finishing and in addition, accustomed to handling both male and female labour. Good salary will be paid to one able to get output with quality. House will be provided.—Box No. 1169, "Electrical Times. (E 329)

JUNIOR DRAUGHTSMEN required with experience in quantity production of telecommunication equipment or small electrical apparatus. These vacancies carry good salaries and offer scope for advancement to selected applicants.—Apply, in writing, giving details of experience, to Personnel Manager, Telephone Manufacturing Co., Ltd., Martell Road, West Dulwich, London S.E.21. (E 299)

JUNIOR DRAUGHTSMAN required for detail and assembly drawing, modifications and schedule preparation for manufacturers of electro-mechanical devices in West London area.—Write full details of experience and salary required to Box No. 1149, Electrical Times. (E 292)

REVO ELECTRIC CO., LTD., require ADDITIONAL SALES REPRESENTATIVES for the London area. Applicants should be 30-35 years of age, have good electrical background, should be resident in this area, and possession of a car would be an advantage. Only men of proved ability considered.—Applications should be made, giving full details of experience, salary required, etc., in confidence, to Sales Director, 30 Great Queen Street, London W.C.2. (E 322)

SENIOR AND JUNIOR ELECTRICAL DESIGNERS required by well-known company in Manchester area engaged in manufacture of all classes of a.c. and d.c. Dynamo Electric Machines from 5 to 5,000 h.p./kW. Salary according to qualification and experience.—Box No. 1135, Electrical Times. (E 283)

SENIOR DRAUGHTSMAN for detailing L.T. metalclad switchgear, modern factory conditions, 5-day week, good rates, and assistance in obtaining accommodation.—G. P. Dennis, Ltd., Fleming Road, Speke, Liverpool 19. (E 232)

SENIOR DRAUGHTSMEN required, with experience in design of manual or trunk telephone equipment and apparatus. These vacancies carry good salaries and offer scope for advancement.—Write, giving full details of experience, to Personnel Manager, Telephone Manufacturing Co., Ltd., Martell Road, West Dulwich, S.E.21. (E 298)

SENIOR DRAUGHTSMAN required with experience in design of telecommunication equipment or small electrical apparatus for quantity production. Good salaries to selected applicants and the positions offer good prospects for advancement.—Apply, in writing, giving fullest possible details of experience, to Personnel Manager, Telephone Manufacturing Co., Ltd., Martell Road, West Dulwich, London S.E.21. (E 300)

SENIOR ENGINEER required in S.E. London for apparatus design in the light electrical engineering field. Familiarity with measurement and life testing technique necessary. Salary according to experience and qualifications in the region of £700 p.a.—Write, giving full details, to Box No. B5434, A.K. Advg., 212a Shaftesbury Avenue, W.C.2. (E 321)

TECHNICAL ASSISTANT for interesting work in small laboratory engaged in development of mass-produced electrical switchgear and control devices in modern West London factory. Minimum qualifications, Ordinary National. Laboratory experience essential.—Box No. 1161, Electrical Times. (E 310)

TELEPHONE MECHANIC. A vacancy exists at a large works in Neath district for a Telephone Maintenance Mechanic, experienced in the maintenance of Strowger type automatic exchange apparatus and associated equipment. He must be capable of locating and repairing faults on overhead lines and multicore telephone cables and on subscribers' apparatus.—Apply, Box No. 1131 Electrical Times, stating experience, etc. (E 259)

THE FORD MOTOR COMPANY require to fill the appointment of SHIFT CHARGE ENGINEER in their power house. Present capacity equivalent to 70,000 kW. Candidates must have a sound technical training and be experienced in all branches of engineering associated with the design and operation of high-pressure boiler and turbine plant. They should be in possession of technical qualifications admitting to corporate membership of a recognised professional institute. Salary £750 p.a. The post is permanent and pensionable. Applicants should reply very fully to Labour Relations Division, Ford Motor Company, Dagenham, quoting reference E.JKH CE. Those who replied to our previous advertisement for Assistant Shift Engineer or Assistant Mechanical Maintenance Engineer need not re-apply for this post. (E 332)

STOREKEEPER (Male) required for wholesalers, West London area, 25/35, preferably with similar experience, permanent position with prospects.—Reply in confidence giving particulars of experience and wages required to Box No. 1139, Electrical Times. (E 286)

TRANSFORMER TEST FOREMAN required by Midland firm. Experience of power transformers up to 30 MVA and voltages up to 132 kV, on-load gear, etc., essential.—Details of experience, salary, age, etc., to Box No. 1109, Electrical Times. (E 231)

APPOINTMENTS WANTED

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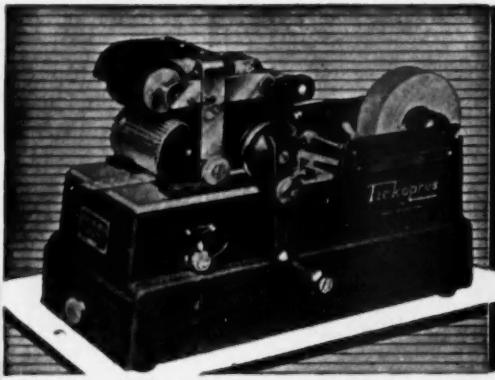

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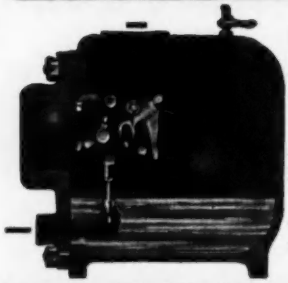

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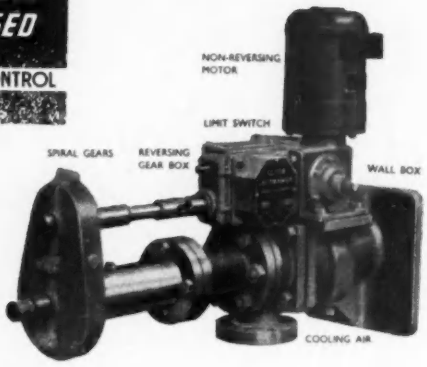

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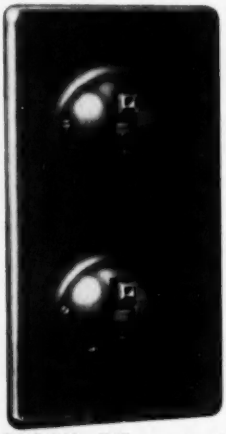

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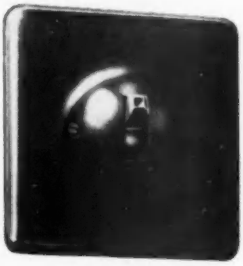

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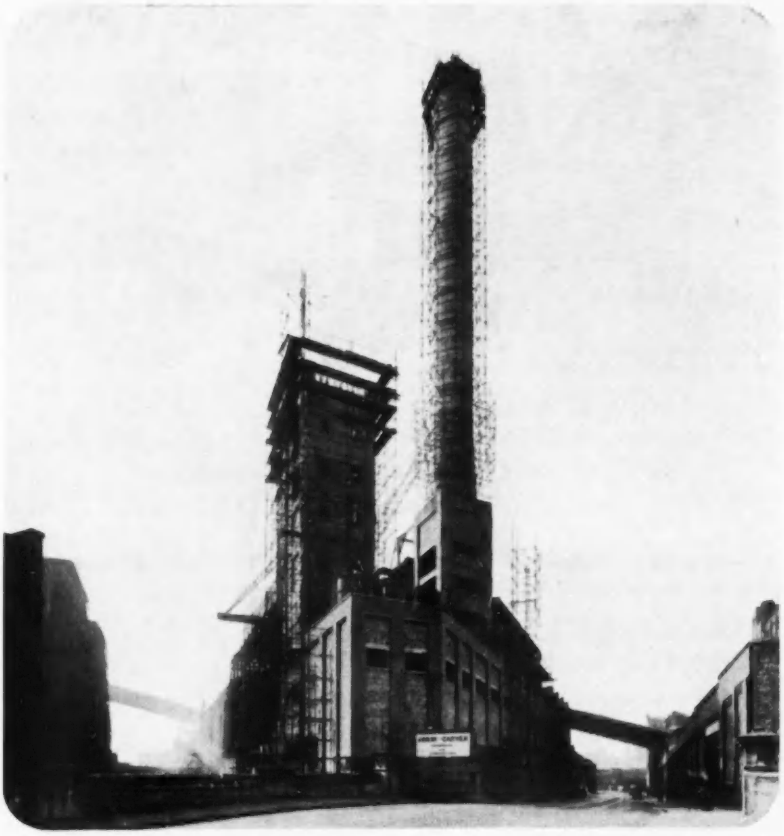

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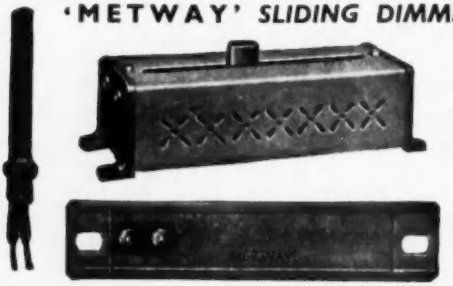

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Complete RECTIFIER SUBSTATION EQUIPMENTS

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Hewittic Rectifiers

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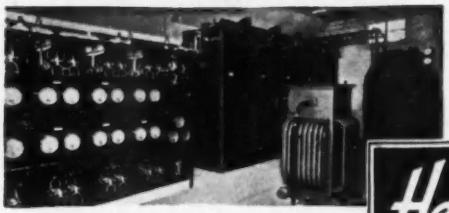
and associated switchgear

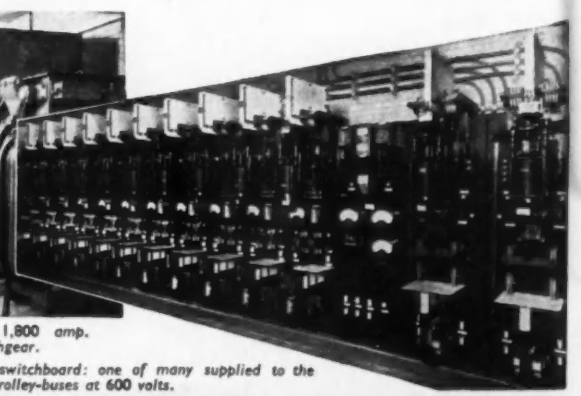


A complete Hewittic substation feeding a Light and Power network in the London area. Equipment illustrated includes an induction regulator for voltage control, main transformer and D.C. switchgear.

A substation on the Midland Region of British Railways, with Hewittic Rectifier (centre), H.V. switchboard (left) and high-speed D.C. switchgear (right)—all supplied and installed by Hackbridge and Hewittic Electric Co., Ltd.

Hackbridge and Hewittic Electric Co., Ltd., have supplied complete equipment for a very large number of rectifier substations, including in each case not only the Hewittic Rectifier—simplest, most reliable of all converting plant—but also the whole of the H.V. and L.V. switchgear.

The Company will gladly offer its advice and quotation for complete equipment, with the assurance—from long experience—of a thoroughly satisfactory installation, modern in lay-out and efficient and trouble-free in operation.



An industrial substation, comprising 1,800 amp. Hewittic Rectifiers and associated switchgear.

On right, A 14-panel flat back D.C. switchboard: one of many supplied to the London Transport Executive for feeding trolley-buses at 600 volts.

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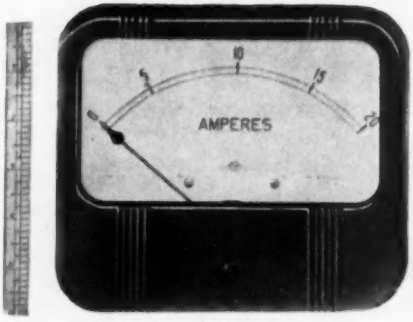

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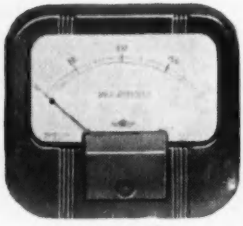

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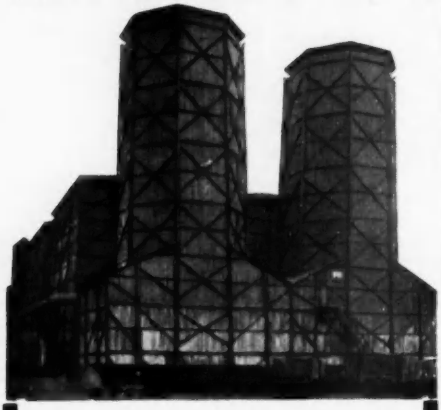

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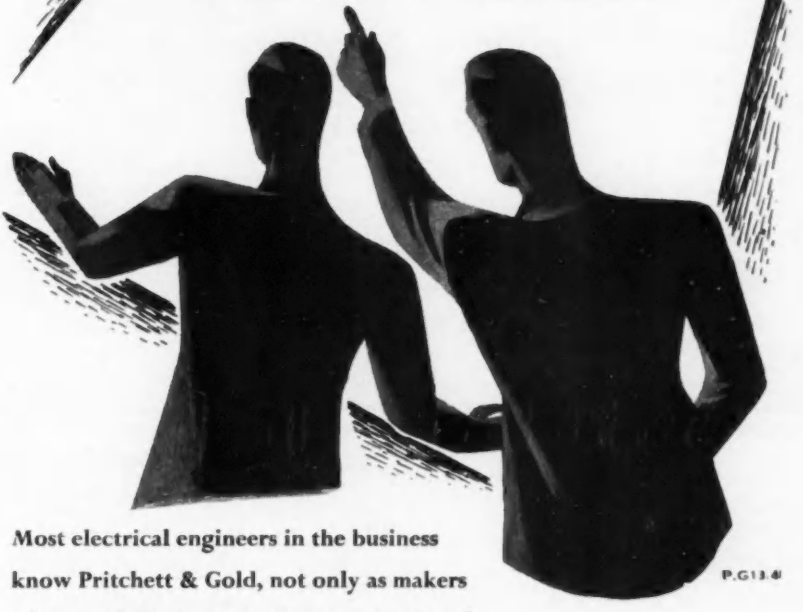

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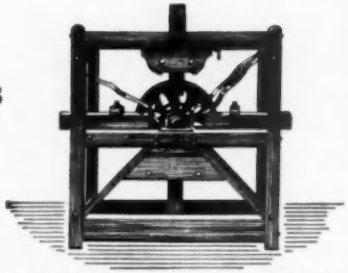

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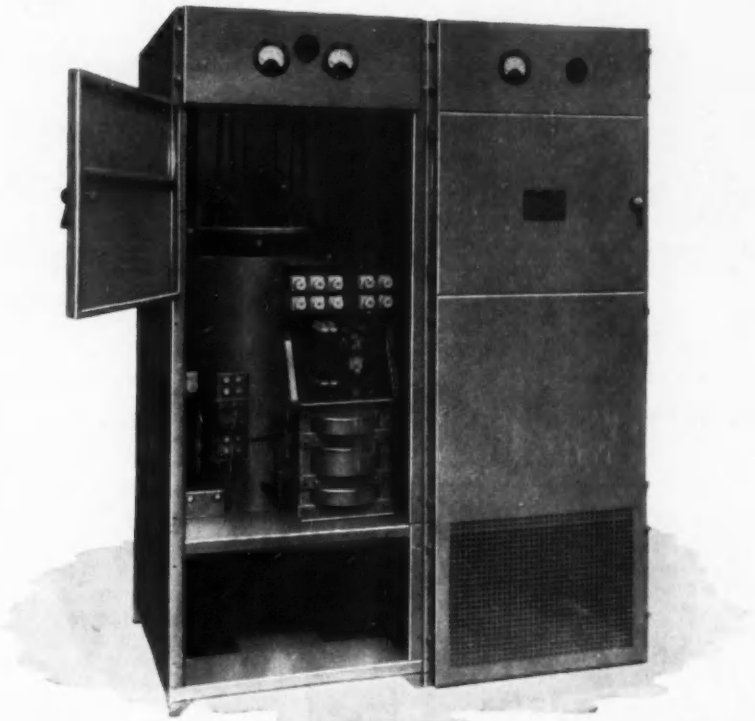
Mercury-arc Rectifiers

Pumpless Steel-tank Type



The BTH pumpless, air-cooled, mercury-arc rectifier is the simplest of the steel-tank types and has been well proved in service. The rectifier with its auxiliaries is enclosed in a cubicle, which will also accommodate the D.C. switchgear when required. The rectifier will start and quickly carry heavy loads, and has an inherent overload capacity well suited to most types of service. Relatively small floor space and light foundations are required. Two or more equipments may be operated in parallel from one transformer. Illustration shows a typical 800 kW., 500 volt, two-cubicle rectifier equipment, with lower cover removed.

Practically every type of power converting plant is designed and manufactured by BTH

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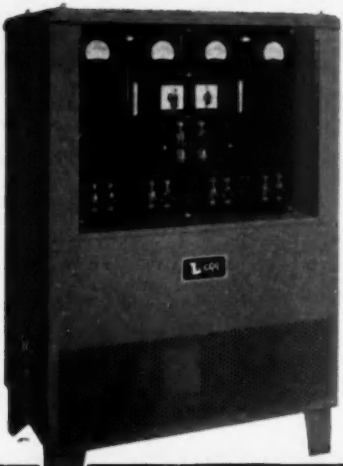

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FOR USE WITH SWITCH TRIPPING BATTERIES

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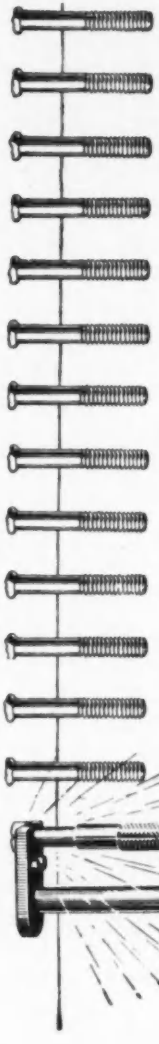

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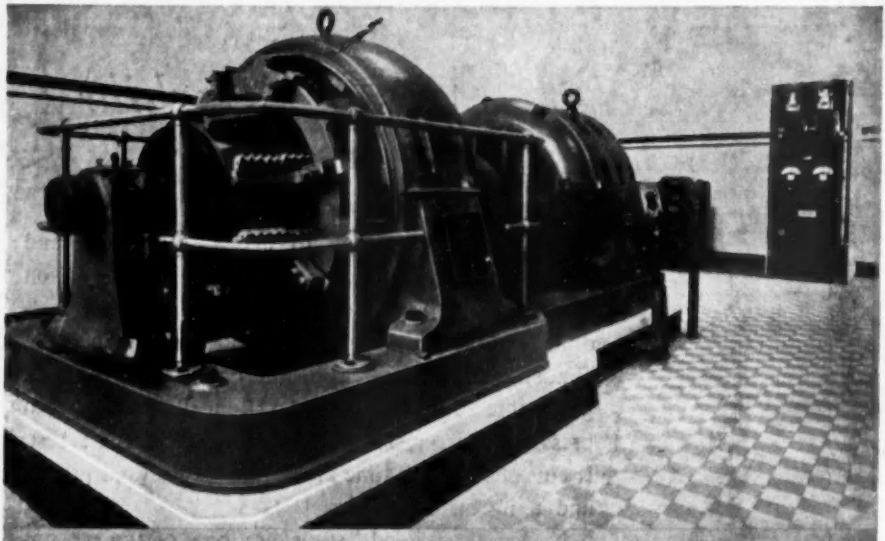

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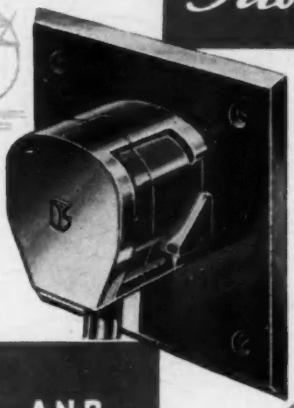

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